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MAGAZINE

SOFTWARE

**Throw Away Your
Screwdriver!
11 Setup Packages
Look Inside Your PC**

FREE UTILITY

**Customize Your
Win 3.0 Desktop
With IKE, Our Handy
Icon Editor**

COMMUNICATIONS

**MNP 5 Is Great;
V.42bis Is Better.
We Test 21 Sub-\$300,
2,400-bps Modems**

LAB NOTES

**Harness WinWord's
Power: Make Your
Own Macros, Menus,
And Templates**

MARCH 26, 1991

THE INDEPENDENT GUIDE TO PERSONAL COMPUTING

VOLUME 10 NUMBER 6

Sweet Sixteens

16-Inch Monitors Move In

- 30 Percent More Screen
- Just Right for *Windows*
- PC Labs Tests 10 Displays



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13

It took us
thousands of
steps to make
this spreadsheet
do what we
wanted.

B

Pro Forma In

1991

184,845

49,292

1,232,300

1,466,437

184,845



Some of the PowerFlex
Family's awards



If you think that equipping everyone in your office with a fast, AT-compatible system is beyond your budget, then you need to look at the 16-MHz, **386SX**-based SX PowerFlex from ALR. This space-saving system gives you all of the features that you need in a desktop system, plus compatibility with the widest range of PC software *and* a few advanced ALR extras, for a starting price that will make office automation a reality for everyone in your office - **\$1195**.

And if a low price isn't enough to convince you, take a look at this fact. The ALR SX PowerFlex is the only 16-MHz 386SX-based system with ALR's advanced **Just Upgrade the CPU!**[™] technology. Unlike most PCs, the ALR SX PowerFlex can actually grow with your business. Suppose that next year

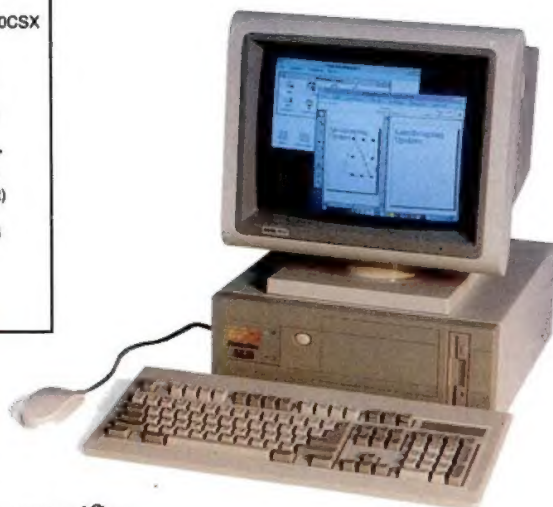
your workload increases or your software requirements change, and you need a more powerful system. With most PCs, you'd be forced to start shopping for a new computer. But with the ALR PowerFlex, you can just plug in one of ALR's economical PowerFlex 20-MHz 386SX[™] or 25-MHz i486[™] CPU upgrade modules, and watch it fly through complicated applications such as desktop publishing and presentation graphics.

There's A Better Way To Get A PC On Every Desk.

The ALR **SX** PowerFlex 16-MHz 386SX™ Power...

...\$1195

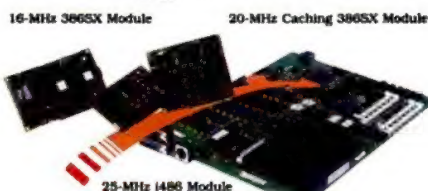
ALR PowerFlex Family			
Model	PowerFlex 80286	SX PowerFlex 386SX	PowerFlex 20CSX 386SX
CPU	80286	386SX	386SX
CPU Speed	12.5-MHz	16-MHz	20-MHz
Std. RAM	1-MB RAM	1-MB RAM	1-MB RAM
Exp. on Motherboard	5-MB RAM	5-MB RAM	5-MB RAM
Total RAM Expansion	16-MB RAM	16-MB RAM	16-MB RAM
Memory Cache			32-KB
Floppy Drive Std.	1.44-MB 3.5"	1.44-MB 3.5"	1.44-MB 3.5"
Hard Drive Available	40-, 106-MB	40-, 106-MB	40-, 106-MB
Expansion Slots	6- 1 (8-16-bit) 5 (16-bit)	6- 1 (8-16-bit) 5 (16-bit)	6- 1 (8-16-bit) 5 (16-bit)
Upgrades to:	16-MHz 386SX, 20-MHz 386SX 25-MHz i486	20-MHz 386SX 25-MHz i486	25-MHz i486
Starting Price	\$995	\$1195	\$1749



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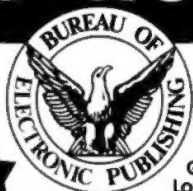
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CIRCLE 180 ON READER SERVICE CARD

Inside

Remember the old woman who lived in a shoe? The one with so many children that she didn't know what to do? Well, that's how we at *PC Magazine* get to feeling about new products sometimes. There are so many of them to be taken care of! And that's why we're constantly looking for ways to provide new and innovative product coverage.

Each day our mailboxes overflow with announcements heralding new and improved PC hardware and software.

Making order out of this chaos is the job of Cristina "New" Córdova and Nate "Improved" Zelnick. The culmination of their efforts appears in the New and Improved pages of *PC Magazine* each issue. Informal statistics indi-

cate that they receive from 25 to 50 product announcements each day. That's over 100 announcements a week; 200 announcements to pore over for each installment of New and Improved.

In addition to tracking the paper-filled world of press releases, Córdova and Zelnick cut piles of faxes down to size, keep an eye on the on-line services, field a steady stream of phone calls, and open their fair share of shrink wrap. You'd be hard pressed to find a product that's new to them.

Choosing which of the products finds its way onto New and Improved's pages is the next part of the job. This



requires keen product instincts and an ability to cut through to the core of what's most important for you, our reader, to know about.

Maybe you've noticed that we've recently redesigned the New and Improved pages in order to give Córdova and Zelnick the optimum format in which to do the job. New and Improved now covers more products more systematically than ever before.

You'll still find our Hot Prospect—the item that we feel deserves

your closest attention. You'll read our newly designed Briefs—a quick scan of the industry, arranged by product category. You'll see the most newsworthy products receive timely, detailed, and insightful coverage. Plus, you'll get cov-

erage of trends. When four companies announce 24-bit scanners in a single week, you can bet that our editors will sniff out the pattern and keep you in touch with emerging technology.

And lest you think that New and Improved is the only place in the magazine with "old woman in the shoe" syndrome, look again. Our cover story looks at the proliferation of large-screen, high-resolution monitors. Life with GUIs and the corresponding increase in graphical applications has made traditional 12- or 14-inch desktop monitors seems as overcrowded as the shoe itself.—Robin Raskin ■



Together, Córdova and Zelnick juggle product announcements, phone calls, demos, and shrink wrap to make sure that you're in the know.

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†Patent Pending

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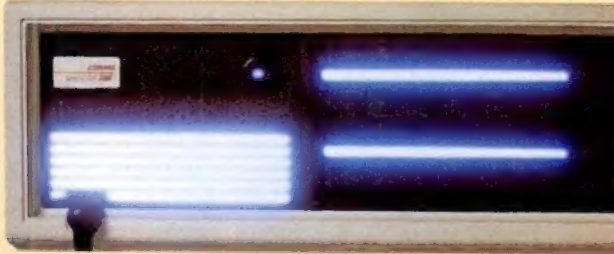


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System Setup: The Inside Story

Jim Seymour/ What's going on inside your PC? How is it configured, exactly? A good system setup and configuration reporting package will tell you about your disks, your memory, your ports, and more, all in a matter of seconds.

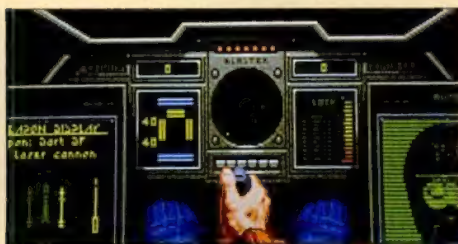


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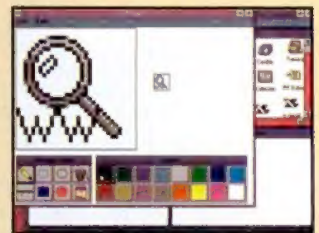
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Except where noted: All *PC Magazine* reviews are of currently available products. Comparative reviews are arranged alphabetically by product name for software, by company name for hardware. Software is free from copy protection. On benchmark test charts, shorter bars indicate faster products (less time to complete a task). Benchmark and performance tests are run on Compaq 386/25s.





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"When you combine... the attractive pricing with Austin's faster-than-average performance, quality components, expansion possibilities, and "made in America" philosophy, it's easy to give the Austin... an unqualified recommendation."-*PC Magazine*, Editor's Choice Review

"Austin's 386/25 WinStation is a system loaded with value, with the added benefit of top-level customer service and support policies."-*PC Magazine* 386/25 Editor's Choice Review

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FCC Class B

HIGHLIGHTS

- 80386/DX Intel 25MHz Microprocessor
- 2Mb RAM (Expands to 16Mb with high speed memory slot)
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Super VGA Color Monitor with 1024 x 768 Resolution
- Super-Charged VGA Video Adapter with 512K VRAM
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- Complete System only \$2890!

"Austin's 386/25 WinStation is a system loaded with value, with the added benefit of top-level customer service and support policies." *PC Magazine, 386/25 Editor's Choice Review.* This full-blown 386 comes with 2Mb RAM, 125Mb hard drive

with 32K cache, 1024 x 768 resolution VGA color monitor and GE on-site service.

AUSTIN 386/25 WINSTATION

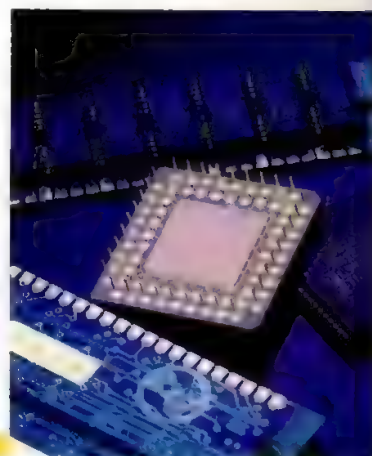
STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
 - Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
 - 7 Expansion Slots (1 8-bit and 6 16-bit)
 - 80387 Math Coprocessor Socket
 - 1 Parallel and 2 Serial Ports
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 - Real-Time Clock with Battery Backup
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 - Compatible with DOS, OS/2, and Unix
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- Additional Floppy Drive. \$79



FCC Class B

HIGHLIGHTS

- 80386 Intel 32MHz Microprocessor
- 4Mb RAM (Expands to 16Mb with high speed memory slot)
- 128K System Cache
- 125Mb Super-Fast IDE Hard Drive with 32K Cache
- 14" Super VGA Color Monitor with 1024 x 768 Resolution
- Super-Charged VGA Video Adapter with 512K VRAM
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- New Small Footprint Chassis
- Complete System only \$3490!

AUSTIN 386/33 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Intel 80387 or Weitek 3167 Math Coprocessor Socket
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

Complete 1024 x 768 Super VGA Color System with 125Mb Hard Drive, 4Mb RAM and GE On-Site Service Just \$105 Mo.¹

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AUSTIN 386/33 UPGRADE OPTIONS

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- Additional Floppy Drive. \$79

Want to go incredibly fast? The Austin 386/33 will show you how fast fast can be. With its 4Mb RAM, 125Mb hard drive with 32K cache, and 128K system cache...you'll speed through everything. But don't just take our word. Deskdrive it!

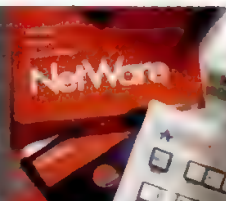


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FCC Class A

HIGHLIGHTS

- 486 Intel 25MHz Processor
- EISA Bus Architecture
- 4Mb RAM (Expands to 64Mb on system board)
- Internal 8K Cache and Floating Point Unit
- Additional 64K External Cache (expands to 256K on system board)
- 125Mb Super-Fast Hard Drive with 32K Cache
- 14" Super VGA Color Monitor with 1024 x 768 Resolution
- Super-Charged VGA Video Adapter with 512K VRAM
- Landmark v1.14 Rating-113.8MHz
- Complete System only \$5890!



AUSTIN 486/25 WINSTATION

STANDARD FEATURES

- 832-bit EISA/ISA Compatible Slots
- 6 Slots available for Bus Masters
- 4167 Weitek Math Coprocessor Support
- Shadow RAM Caching (BIOS/Video)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- Floppy Drive (1.44Mb or 1.2Mb)
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- RealTime Clock with Battery Backup
- Microsoft Windows 3.0 and MS-DOS
- Microsoft Mouse
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Complete 1024 x 768 Super VGA Color System with 125Mb Hard Drive, 4Mb RAM and GE On-Site Service...Just \$177 Mo!

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AUSTIN 486/25 UPGRADE OPTIONS

- Upgrade to an Ultra-Fast 175Mb Hard Drive with 32K Cache. \$400
- Additional Floppy Drive. \$79

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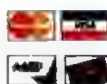
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HIGHLIGHTS

- 80286 16MHz Microprocessor
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- 40Mb IDE Hard Disk Drive
- Floppy Drive (1.44Mb or 1.2Mb)
- VGA Monochrome Monitor with VGA Video Adapter
- Complete System for only \$1290.

FCC Class B

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AUSTIN 286/16

STANDARD FEATURES

- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
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- 1 Parallel Port and 2 Serial Ports
- 80287 Math Coprocessor Socket
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Built-in Setup Program
- Compatible with DOS and OS/2
- American-Made Motherboard

Complete VGA System with 1Mb RAM, 40Mb Hard Drive, and GE On-Site Service... Just \$39 Mo!

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**HIGHER
RESOLUTION
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HIGHLIGHTS

- 80386SX Intel 16MHz Microprocessor
- 2Mb RAM
- 40Mb IDE Hard Drive
- 14" Super VGA Color Monitor with 1024 x 768 Resolution
- Super-Charged VGA Video Adapter with 512K VRAM
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- Complete System only \$2090!



AUSTIN 386/SX16 WINSTATION

STANDARD FEATURES

- Floppy Drive (1.44Mb or 1.2Mb)
- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
- 1 Parallel and 2 Serial Ports
- Enhanced 101 Keyboard with Tactile/Click Touch
- Real-Time Clock with Battery Backup
- Compatible with DOS, OS/2, and Unix

Complete 1024 x 768 Super VGA Color System with 2Mb RAM, 40Mb Hard Drive and GE On-Site Service... Just \$63 Mo!

\$2090

AUSTIN 386/SX16 UPGRADE OPTIONS

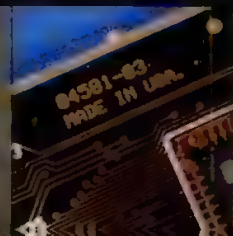
- Upgrade to Fast 85Mb Hard Drive with 32K Cache. \$150
- Additional Floppy Drive. \$79

FCC Class B

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AUSTIN 386/SX20 WINSTATION

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- Dual Floppy/IDE Hard Drive Controller—1:1 Interleaving
- 7 Expansion Slots (1 8-bit and 6 16-bit)
- 80387/SX Math Coprocessor Socket
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- Enhanced 101 Keyboard with Tactile/Click Touch
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- Compatible with DOS, OS/2, and Unix

Complete 1024 x 768 Super VGA Color System with 2Mb RAM, 85Mb Hard Drive and GE On-Site Service Just \$71 Mo.!

\$2350

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- Additional Floppy Drive. \$79

HIGHLIGHTS

- 80386SX Intel 20MHz Microprocessor
- 2Mb RAM
- 85Mb Fast IDE Hard Drive with 32K CacheFlow™ Cache
- 14" Super VGA Color Monitor with 1024 x 768 Resolution
- Super-Charged VGA Video Adapter with 512K VRAM
- Pre-Loaded with Microsoft Windows 3.0 and MS-DOS 4.01
- Microsoft Mouse
- Complete System only \$2350!



FCC Class B

In *PC Magazine's* 386/SX-20 Editor's Choice review, they said, "The Austin 386/SX-20 PowerStation narrowly missed this award (Editor's Choice) because the FCC had not yet granted it Class B status...!" Well, guess what! We've got it now!

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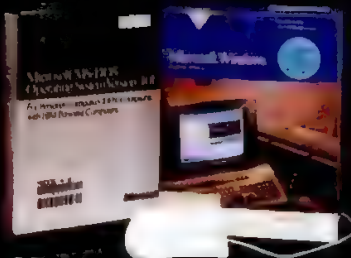
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Letters

IS PHOTOGRAPHY DEAD?

John Dvorak's *Inside Track* (December 25, 1990) made mention of the family uses of the new Kodak photographs on the CD-ROM standard. He forgot one important aspect of using this technology in the modern American family setting.

Aside from distorting images of the kids, you will be able to replace or delete absentee or divorced spouses from the family album. Like the picture but can't stand the person? Zap—he's gone.

Drew A. Harris

Linden, New Jersey

What a laugh. John Dvorak says that photography as we know it is dead. Soon we will put images on CD-ROMs at HDTV resolutions, etc., etc. How many discrete elements are there on an HDTV, a couple of million, maybe? Fine-grain film probably exceeds that per square centimeter. Want to see a picture of the baby? Sure, I've got this little CD here in my wallet.

Hey, John, switch to decaf.

Ted Horvath

Windsor, Ontario

IT PAYS TO BE DVORAK

Regarding John Dvorak's *Inside Track* column (December 25, 1990): I purchased the Zeos Notebook 286 almost as soon as it came out. While I am still waiting for my back-ordered internal modem, I am very pleased with this machine. However, when I opened my shipping box, it did not say thank you, and the carrying case did not have any blank disks in it.

Rank has its privileges.

Alan Besterman

East Chatham, New York

Mr. Besterman later received the following letter from a Zeos rep:

Dear Mr. Besterman,

It has come to my attention that you did not receive your free disks in the carrying case of your new Zeos notebook computer. I apologize for the oversight and am



John C. Dvorak is always in the center of controversy.

enclosing two disks to make up for the error.

As for the "Thank You" on the box, I'm sorry you missed it; it is preprinted on the inside flap of all of our boxes right at the printer. But since you missed it, please accept this "Thank You" as an even more personal expression of our appreciation for you as a customer.

Rick Apple

Director of Marketing
Zeos International

THE DEATH OF CODE

The entire November 13 issue could have been dedicated to Dvorak's topic "The Death of Code." Congress, judges, and the industry need to hear more outrage than could be provided on one page. I hope that more of us with the same opinion will actively support Richard Stallman in his efforts.

Yet some will tell you that it can and should get worse. Whether it does or not and whether the decision against Paperback Software can be reversed, there are some things that can be done. First, when consulting with customers, recommend a

spreadsheet other than *Lotus 1-2-3*. There are several spreadsheet programs that are better and easier to use.

Second, agile companies like Paperback and Borland should design their software with a user-installable interface, something unique that the end user could change to make it look like whatever he wants to. Doesn't it make you chuckle to imagine Lotus trying to sue millions of users who have installed an interface that looks like Lotus's?

Thomas G. Berchulski

Higganum, Connecticut

WHATEVER HAPPENED TO . . .

Here's one for the suggestion box. Would you be interested in starting a "Whatever Happened To . . ." column? In such a dynamic industry, it is inevitable that we lose track of many products, people, and companies that have either changed direction, merged, gone under, or at least back to the drawing board.

Whatever happened to *NewViews*, the CP/M operating system, the author of the original DOS code, and the author of the original *Microsoft Flight Simulator*? Ask your readers who they want to know about.

Keith H. Mitchell

New Braunfels, Texas

GET RID OF JARGON

In his search for the meaning of the word *hacker*, Bill Machrone ("What's in a Name?" December 25, 1990) did not go back far enough in time. For the many decades that I can remember, *hacker* has been a derogatory term within the blue collar trades for one who goes into a machine shop and "hacks out" parts with inappropriate tools and inept technique.

By extension to the computer age, a hacker would be one who misapplies computer hardware and/or software, for example, by building "blue boxes" or by writing bug-laden code. The term certainly should not apply to computer professionals, hobbyists, or amateurs (derived from the Latin *amare*, to love) who work with

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Letters

skill and good intent.

I agree fully with Bill Machrone's closing comment: "It's everyone's responsibility to police the language and keep our communications as meaningful and free of unnecessary jargon as possible."

Wallace R. Rust
Greece, New York

COMING UP: CAME AND WENT

What's happened to Coming Up? My neighborhood theater wouldn't think of showing a main feature without showing the trailers first. Certainly you're no less interested in enticing me to buy your next issue.

Frank S. Whelan
Portland, Oregon



We like the previews as much as the next guy, but sometimes unavoidable production events oblige us to stick to the features and the shorts.—Ed.

TEACHERS SHOULD BE REAL PEOPLE

George C. Gross (Letters, December 11, 1990) says that computers could be used to self-teach subjects like reading and geography, and therefore we could fire some teachers and save money.

Gross is as ignorant as he is mean-spirited. Nothing can possibly take the place of a real, live, caring human being in the grade-school environment—nothing. Certainly some teachers are not so hot. But even Mr. Gross must have one teacher whom he remembers fondly. What emotional growth or stimulation can be obtained by being self-taught, in isolation, using images on a cathode-ray tube?

Take, for example, the statement by John Scully, CEO of Apple Computer:

"We expect our teachers to handle teen pregnancy, substance abuse, and the failings of the family. Then we expect them to educate our children."

Even an Apple computer, user friendly as it is, can't be friendly enough to do any one of the above.

Donald W. Chilton
Huntington, New York

A PREPACKAGED WORLD

In response to Roger Claff's comments in the December 25, 1990, Letters

column ("Students should be taught how to program properly and not to be dependent on prepackaged software."), I must pose the question: Should students also be taught automotive engineering rather than learn to depend on a prepackaged automobile?

History has taught us to build upon each other's achievements, a concept that

**Nothing takes the
place of a real, live,
caring human being
in the grade-school
environment.**

inspired the phrase exhorting us not to "reinvent the wheel." Computer literacy does not necessarily have to include in-depth programming skills, but rather the know-how to make the tools available aid in the results desired.

Matt Smith
Atlanta, Georgia

HE'S SEEN THE FUTURE

Again I see confusion among *PC Magazine* readers concerning the advantage of *Microsoft Windows 3.0*. The next time I have to separately install video drivers for *AutoCAD*, *Ventura Publisher*, *Windows*, and a host of other applications, I am going to ask Derek Hawkins (Letters, January 15, 1991) to do it for me.

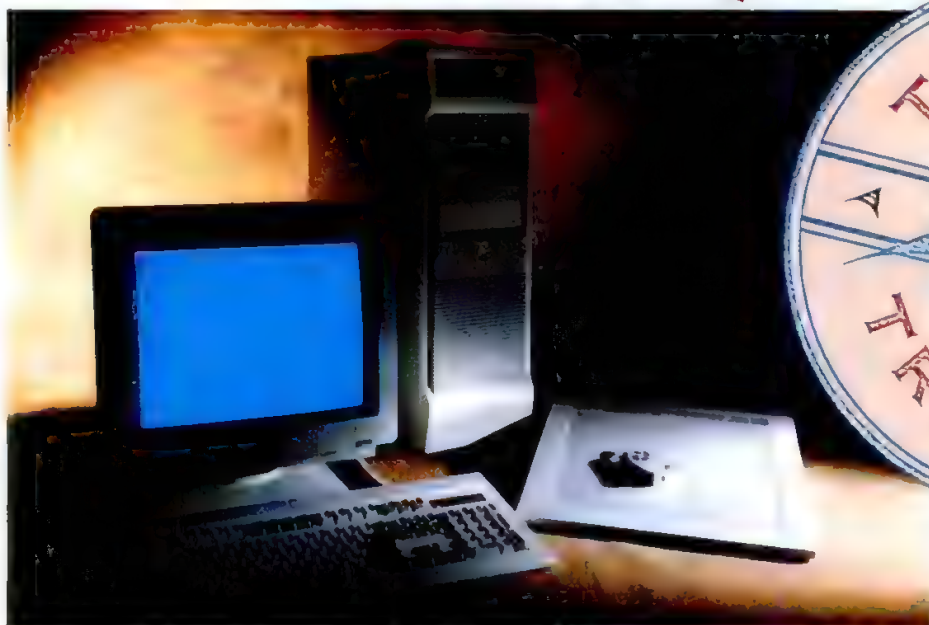
You see, one of *Windows*' most attractive features for users as well as for hardware manufacturers is that one video driver handles all applications that run under *Windows*. Hence *Windows* has great marketing appeal for makers of specialized printers and other equipment, like scanners, mice, and so on.

Get the picture, Derek? Have patience. Over time, *Windows* will speed up and so will our microprocessors. It sure beats having dozens of specialized device drivers scattered all over our hard disks, doesn't it?

As major applications such as *WordPerfect* begin switching over to *Windows*, remember how easy it will be for them to surprise us with OS/2 2.0 32-bit versions. Just think of it. Our favorite software applications with their beautiful new interfaces,

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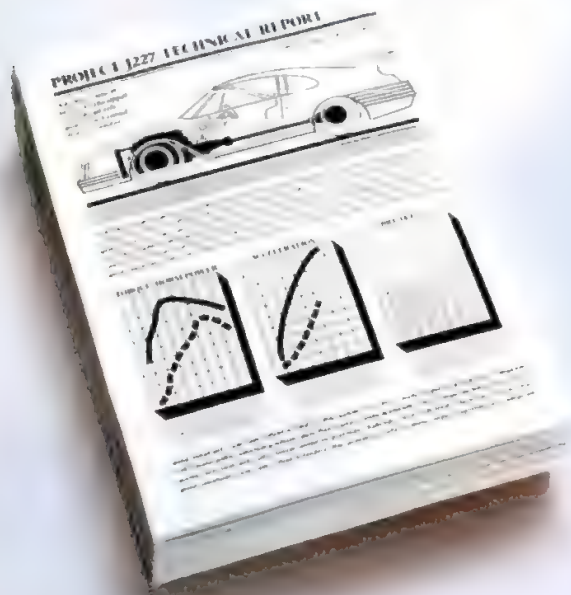
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And while you've been honing your design skills, we've been improving our program. Besides an impressive array of features that *PC Week* describes as "a complete graphics art studio," here are a few new ways we'll be keeping the competition deep in thought:

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M I C R O G R A F X

Letters

with no DOS-imposed 640K memory barrier, all multitasking! That is the future.

John DeRegnaucourt
Dayton, Ohio

HOW MANY WORDS DOES IT REALLY TAKE?

Personal computers are wonderful, I agree. And I grant that you folks are professionally obligated to be computer happy. But on reading the opening lines of your December 11 cover story on word processors—"No one has estimated the number of words the average computer processes during its lifetime, but the amount could easily be in the billions."—I just could not resist.

To make it easy, let's assume continuous creation of text at 50 words per minute, which amounts to 72,000 words (or just under 300 pages of manuscript) per day, a bit over 25 million words per year, a billion words in just over 38 years. (And since that pace leaves no time for deleting old files or other ancillary tasks, the machine had better start out with a sizable amount of mass storage, and system MTBF exceeding 300,000 hours.)

Billions? I think not.

Theodore S. Sims
Washington, D.C.



Yes, but writing 100 million words and copying them to ten other files would take only four years.—Ed.

A COPY EDIT MISTAKE?

As a former technical editor for *LAN TIMES*, I always appreciate seeing columns that recognize the contributions copy editors make to the book. *Sports Illustrated* is the only other publication I am aware of that regularly gives editorial credit to copy editors.

I can only assume that the omission of Karen Carter, your copy edit manager, from the roster of copy editors cited at the end of Don Willmott's Inside column (December 11, 1990) is to test the eyes of the copy editors among your readership.

Deni Connor
Austin, Texas



Good catch. Karen Carter is *PC Magazine*'s manager of copy edit, responsible for supervising all copy editors, proofreaders, and assistant

production editors. These responsibilities do not preclude an occasional afternoon spent with red pencil in hand.—Ed.

MODEM MISCONNECTION

Our phones have been ringing off the hook since an item on Sharp's new 9624/9624e modems appeared in New and Improved (December 11, 1990). While this overwhelming response testifies to *PC Magazine*'s popularity, readers are inferring that we offer a V.32 unit. A clarification is in order.

Sharp's own Extended Baud Rate (EBR) technology provides throughput of up to 9,600 bps with Sharp modems at both ends. EBR supports an exclusive 4,800-bps mode that, when coupled with MNP5 data compression, provides 9,600-bps full-duplex asynchronous operation as well as standard high-performance 2,400-, 1,200-, and 300-bps data modes.

For the record, the Sharp modems are V.22bis-compliant.

Bradley Harring
Manager, Communications Products
Sharp Digital Information Products
Irvine, California

CORRECTIONS & AMPLIFICATIONS

In a First Look at Iomega's Bernoulli Transportable (December 25, 1990) we should have stated that Iomega's Bernoulli drivers *have* a SCSI interface and are compatible with the SCSI standard. But Iomega does not include a free adapter card with the purchase of Bernoulli products.

In the December 11, 1990, New and Improved column, it's stated that the MaxFax 9624LT-T fax/modem board only sends faxes, when in fact it also receives them.

In "Total Recall: Contact Management Software" (December 25, 1990), the screens for *SalesPro* and *TeleMagic* were transposed.

HOW TO WRITE TO PC MAGAZINE

We welcome your comments, complaints, insights, and suggestions. Please send them to Letters, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see page 8 for access information). All letters become the property of *PC Magazine* and are subject to editing.

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by
Gus Venditto

Advisor

386 UPGRADE QUANDARY: ADD A BOARD OR REPLACE THE MOTHERBOARD?

Ever since I bought my AT, I have been steadily upgrading it with memory, VGA, extra floppy, and 40MB hard disks, etc.

If I were to upgrade to a 386 motherboard, would I have to get rid of everything and start from scratch?

I have seen an ad for an accessory board that can substitute the 286 processor with a 386. Unfortunately, it costs as much as a 386 motherboard, in which case I prefer the motherboard because of simplicity. I've grown attached to my old clunker. Any advice?

Juan Julian
Coral Gables, Florida

PC My advice is to first determine the price of a 386 system that would give you everything you have. The ATs sold in the past needed constant upgrading, but the 386 PCs being sold today from \$2,000 to \$3,000 tend to have everything you need: two floppy disk drives, a fast hard disk with plenty of storage space, ports, a mouse, VGA color, and even some valuable software.

Clearly, you will spend more to buy a new system than you would if you perform the upgrade, but take into account that you may be able to sell your current system. The Boston Computer Exchange is a relatively easy way to find a buyer for a system. In their most recent listing of used systems, an IBM AT Model 339 was being offered for \$925. Call them at 617-542-4414 for more details.

If you find the economics favor an upgrade instead of a new system, your instincts are correct: A motherboard replacement is the better solution.

Although it's a fairly involved task to remove all of the old components and detach the power supply, a 386 motherboard will offer fewer hassles than an add-in replacement once you're up and running. The potential for BIOS conflicts when replacing your CPU with an add-in

- **386 UPGRADES:** Add-in board or motherboard replacement?
- **CUTTING WAIT STATES ON A 386:** Can new RAM chips eliminate a wait state?
- **MIXING TEXT WITH GRAPHICS IN A DATABASE:** Three choices for creating illustrated databases.

board is but one reason why a new motherboard is the better alternative.

When you balance the costs, remember that you'll probably want to increase the power supply after you change the motherboard.

Finally, you can save as much of your old system as you wish. The VGA card and color monitor can be reused, and you may be able to get the best deal by plundering your old system and buying only as much of a new system as you need.

The most important thing you can do is to take an honest evaluation of your needs and make sure that when you make the upgrade, you're getting all of the new features you want: The ability to add lots of RAM, coprocessor options, the best video possible, more ports, and hardware caching are all worth considering.

CUTTING WAIT STATES ON A 386

I have a noncached 25-MHz 386 PC with 1 wait state for both reads and writes.

How can I speed up my machine by getting rid of one or both of these wait states? Would this be worth the trouble and cost?

Kevin Daniel
Bend, Oregon



Without knowing the model of your machine, I can't tell if you're one of the lucky people who can eliminate a wait state with faster RAM.

A few—by no means all—386s provide a systemboard jumper that can switch the machine from 1 to 0 wait states.

In order to exercise this option, you do need to replace the system RAM (all of it) with chips rated at either 80 nanoseconds or 100 nanoseconds. Your documentation would have a section on this option, if it can be done on your machine.

Otherwise, there's nothing you can do. Wait states are programmed into system design at a hardware level. A better way to squeeze out more speed would be to consider adding RAM to use in a disk cache or to buy a faster hard disk.

MIXING TEXT WITH GRAPHICS IN A DATABASE

I need a database to combine text and scanned images.

Over the years I've built by hand an annotated bibliography consisting of the reference citation, a numerical key, free-form notes and hand-drawn copies of key illustrations.

Only through an elaborate index am I able to locate the reference or figure of interest. I would like to switch from paper to disk and create these reference sheets on my PC but have been unable to find appropriate software. Do you have any suggestions?

Robert Timmer
Bakersfield, California



Thanks to the sample that you sent in I can see that your application—the presentation of geological analyses on potential reservoir sites—requires more than a graphical database.

With the release of *Windows 3.0*, a number of application development programs have been introduced that let you create documents where graphical im-

Advisor

ages can have either text or other images. In the coming months, you'll see more database applications take advantage of Windows's ability to mix graphics and text and there will be more choices.

Right now, I'd say you have three products to choose from that all run under Windows.

KnowledgePro Windows is the most powerful choice and it may be more power than you need. It was designed as a tool for developers and if you're going to be distributing your software extensively, you may want to take the time to learn *KnowledgePro*, but if this is going to be used only by you and a small group of others, the following two are better choices. (*Knowledge Garden*, Nassau, N.Y.; 518-766-3000; \$695).

Both *ToolBook* and *Plus* are very easy to learn and provide a wealth of features to produce the kind of graphic notebook-database that you envision.

Both run under *Windows* and have a wide range of tools for generating screens

Graphical databases is
one of the fastest
growing segments in
the software business,
so you're going to have
many more choices in
coming years.

that maintain links with other pieces of text or graphics.

Plus, although developed to be compatible with the Macintosh's HyperCard, would be a very good choice for your application even if you have no intention of ever running the software on a Mac.

A comparison between *ToolBook* and *Plus* would require more space than I have room for here; the bottom line is "either one should do the trick."

ToolBook is published by Asymetrix of Bellevue, Wash.; 203-637-1500; \$395.

Plus is published by Spinnaker of Cambridge, Mass.; 617-494-1200; it costs \$495.

My suggestion is to compare the First Looks that appeared on all three. *KnowledgePro* was reviewed in the October 30, 1990, issue of *PC Magazine*, page 46. *ToolBook* was reviewed in the July 1990 issue, page 36. And *Plus* was reviewed in the December 11, 1990 issue, page 36.

If you want to do a thorough comparison of all the options, you should also look at Borland's *ObjectVision*, a decision-tree-oriented graphical database. It is reviewed in *PC Magazine's* First Looks section, February 26, 1991. Borland's approach to graphics presentation uses rule-based structures that may prove easier to implement.

ASK THE ADVISOR

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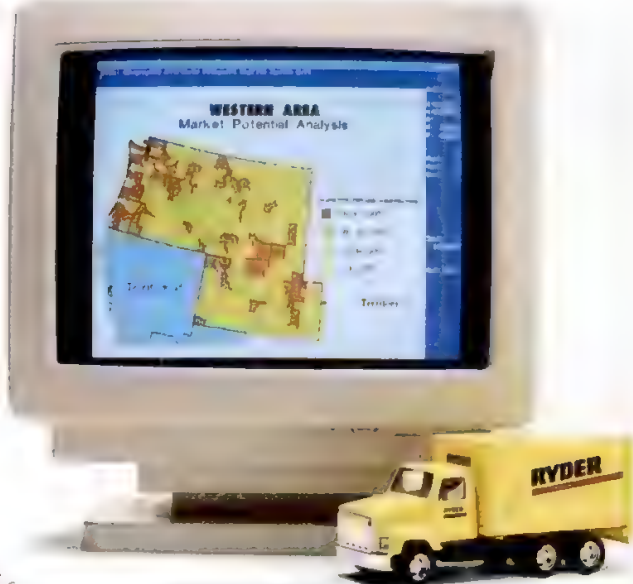
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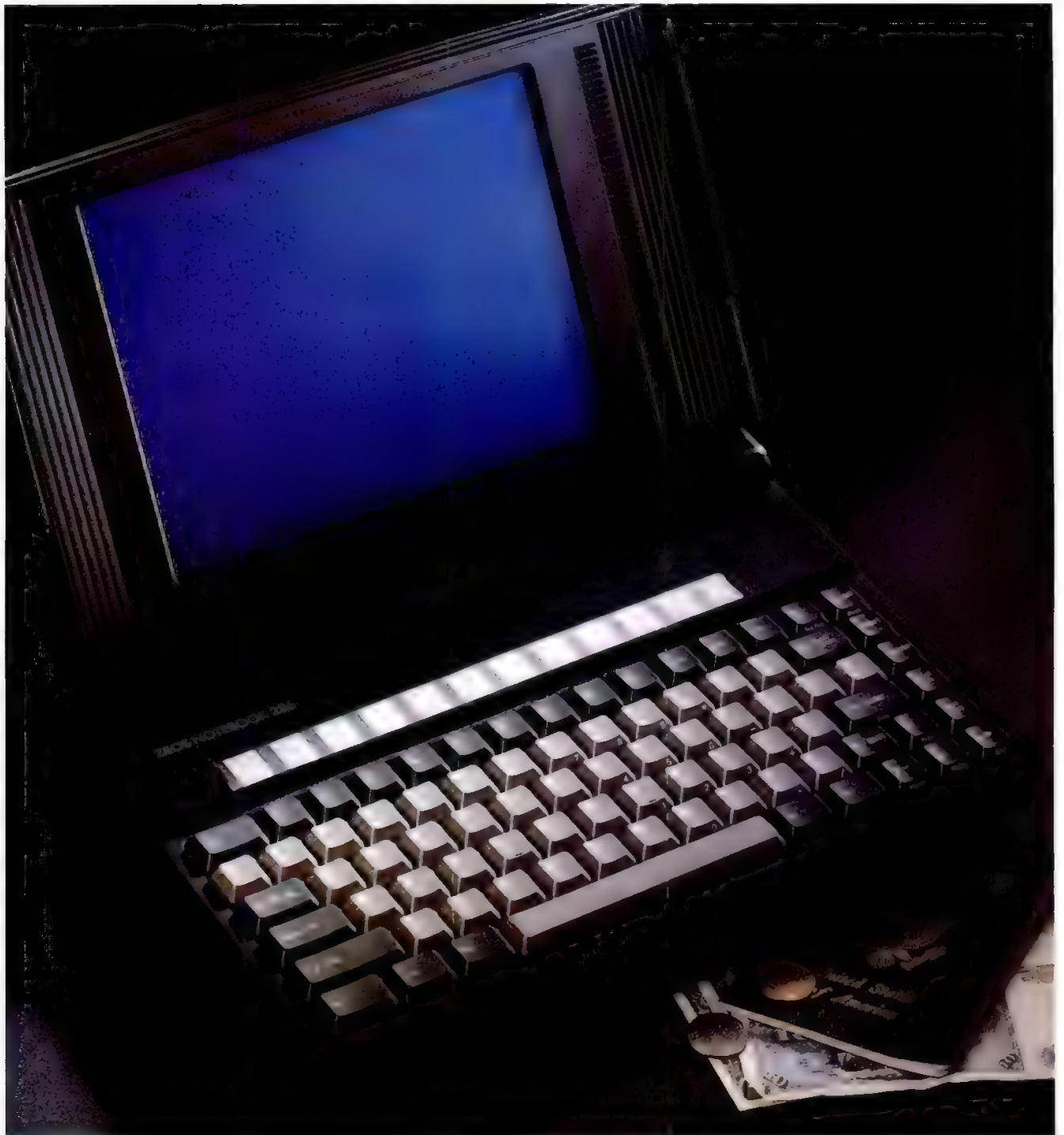
- PC Magazine, *"There's a new king of the hill—the ZEOS Notebook..."*
- John C. Dvorak, *"In this category I'm most impressed with the ZEOS Notebook...it has to be the number one contender."*
- PC LapTop, *"The notebook you've been waiting for."*
- Infoworld, *"This notebook is a steal."*
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First Looks

Hands-on Reviews of the Latest Products

Kodak's \$5,500 Hydra Combines Workgroup Printing And Convenience Copying

HANDS ON
By Anne Foss

Hydra: a relatively new term coined to describe devices that combine four functions in one unit: printing, faxing, scanning, and copying. Hydras promise a high level of functional integration for those with a premium on space and money.

Kodak's \$5,495 Ektaplug 7016 could be described as a half-hydra. It targets the two most common functions—printing and copying—by combining a high-speed workgroup page printer with a photocopier. The combination is seductively attractive, especially when you consider that the 7016 adds other multi-function capabilities such as six different printer emulations. And while the 7016 is not the first attempt at a printer/copier

At 16 ppm, the Ektaplug 7016PS is an outstanding performer.



combo, it is clearly the best yet.

Unlike other hydra devices, one important differentiation is that Kodak designed the 7016 as a workgroup device, not a personal printer. The LED-based print engine is rated at 16 pages

per minute and for an impressive 15,000 pages per month (a ream and a half a day).

We tested the \$6,995 PostScript version of the Ektaplug, the 7016PS. In our PC Magazine Labs printer benchmark



March 26
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tests, it managed 14.5 pages per minute in LaserJet II mode, and 11.0 pages per minute in PostScript mode. These numbers are outstanding, especially when compared with some of the laser printers tested in last year's "printer blockbuster" (November 13, 1990); machines with this type of speed cost nearly twice as much as the 7016PS.

In addition to its speed performance, the 7016PS offers flexible paper handling. Two

CONTINUES ON PAGE 35

Clipboard, Meta Keys, Compiled Scripts—ProComm Plus Continues to Please

HANDS ON
by Rick Ayre

ProComm Plus has gone more than three years without a major upgrade. Version 1.1b, the last upgrade, was released in August of 1988. During that time little changed, except its market share, which continued to grow dramatically. As a matter of fact, over the years, *ProComm* has sustained a regular appear-

ance among the top fifteen sellers as ranked in *PC Magazine's* Pipeline. Given its shareware roots, this is a remarkable achievement. The last available shareware version of *ProComm*—Version 2.43—will no longer be upgraded, but it will continue to be available on electronic BBSs.

ProComm Plus, Version 2.0, shipped quietly, not with the fanfare accorded some other

product upgrades. But its new list of features will delight *ProComm* loyalists. The new offering manages to preserve the familiar interface while adding features that satisfy users looking for better performance, ease of use, and functionality.

For those who are drawn to *ProComm's* ease of use, Datastorm has added Microsoft-compatible mouse support, the ability to customize and sort the dialing directory, and an on-line Help facility that allows you to search the help file for text strings or pick from topic lists. In addition, a new exclusive feature, the filename clipboard,

automates downloading processes.

For those who are concerned with performance, *ProComm* adds support for the 16550a UART and the Zmodem file-transfer protocol. For those who like to customize their communications, keyboard macros have been replaced with much more powerful meta keys. And, in what is probably the most significant change, the Aspect script language has been extended and is now fully compiled.

ProComm's mouse support is accessed through pull-down

CONTINUES ON PAGE 34

First Looks

ProComm Plus

CONTINUED FROM PAGE 33

menus that appear when you single-click the left mouse button (or when you press the unshifted tilde key). The menus are not CUA-compliant, but they do offer direct access to all the *ProComm* features, which can still be evoked with the familiar Alt-key combinations.

The dialing directory has three new commands. These allow you to add a new entry, sort your entries in five different ways, and even attach notes to an entry. The dialing directory now also allows control over port setup variables for each entry and supports all bit-per-second rates.

The filename clipboard is a novel feature designed to automate the selection and transfer of files to your PC from a remote system such as a BBS. While viewing a list of files online you can call up the clipboard by pressing an Alt-key combination, and cut all or some of the filenames into a buffer. You can then send these files one at a time, or in tagged batches, to your computer. File lists stored in the clipboard may be edited, modified, or deleted, and all you do to place a file in the clipboard is choose from a file listing and tap on the Enter key.

PCEDIT, the text editor that comes with *ProComm Plus*, has also been upgraded, though ease of use does not seem to have been the focus of this revision. Chief among its new features is the ability to easily toggle between word processor and programmers' editing modes.

ProComm now supports the MS16550a UART. After detecting the chip's presence, *ProComm* automatically initializes its 16-byte buffer. Use of this UART insures that data transfer at high speeds will not result in data loss, even if the transfer takes place under multitasking environments. Datastorm intends to support the Hayes ESI standard soon, but not in this particular version.

ProComm responds to the proliferation of modems, as many other communications programs have, by offering a list of modems for the user to choose from during installation. The up-to-date modem list contains virtually all of the popular 2,400-bps modems available as well as most of the new 9,600-bps models.

Keyboard macros have been replaced by powerful meta keys. You can now attach text, an Aspect script, an external program, or an external program that "hooks" the session parameters from *ProComm Plus* to one of the ten meta keys. Text meta keys function just as keyboard macros did in earlier versions of *ProComm Plus*, al-

FACT FILE

ProComm Plus, Version 2.0
Datastorm Technologies Inc.,
3212 Lemone Industrial Blvd.,
Columbia, MO 65201; 314-443-3282.

List Price: For a limited time introductory offer, \$119; upgrade from any earlier version, \$39.

Requires: 192K RAM, DOS 2.0 or later, and a modem.

In Short: This new version of what is probably the world's most popular communications package includes a beefed-up scripting language, mouse support, a filename clipboard, and meta keys, but the familiar *ProComm* interface remains unobstructed.

CIRCLE 704 ON READER SERVICE CARD

lowing 50 keys to be recorded and replayed by hitting that meta key combination.

There are three important new things about the Aspect scripting language: the new ASPCOMP compiler, the Aspect language's new syntax and structure (which provides a cross between the structure of Pascal and C's low-level access), and a wealth of new language commands.

Those who have struggled with the *ProComm* script language in the past are in for a refreshing treat. The new version provides everything you might want in a script compiler: speed of execution; encrypted files so that text, such as passwords, are more secure; and dramatic savings in disk storage space. The compiler, when executed from the command line, does a creditable job of catching and reporting errors. When debugging a complicated script, you can generate symbol maps and a source line numbered reference table.

The Aspect language itself closely resembles Version 1.1b's; so closely in fact, that with the help of the enclosed CONVERT program, you can convert and compile most of your scripts written with the earlier versions without any changes.

Once you get a look at the new Aspect commands, syntax and structure, you'll want to re-

write your program to take advantage of all the new features. There are, by my count, more than a hundred new commands. For example, in Version 1.1b, EXECUTE, GOSUB, and GOTO were the only three commands to facilitate decision making in a script. With Version 2.0, you can choose from all the standard decision making and looping constructs including if, for, when, and while, as well some less standard constructs like LONGJMP and SETJMP.

The sample scripts distributed with *ProComm Plus* provide a unique view of what can be done with Aspect. The conversation piece of the sample programs will probably be the complete implementation of a Blackjack program, written entirely in Aspect. Though perhaps the more impressive program is called PORTS. This Aspect script reports on your current communications port configuration, allows you to interactively change the current port, and even allows you to view the contents of the relevant registers. For example, if you select View Registers, and then view the contents of the Interrupt ID Register, you can see by the clearly labeled status bits whether *ProComm* has detected an MS16550a UART, and whether the FIFO buffer has been enabled.

For an unspecified "limited time only," *ProComm Plus*, Version 2.0, is available for the same price as Version 1.1b: \$119. Registered users who upgrade for \$39 will get the new two-manual set (a user manual and a separate manual for the Aspect script language). Registered users will also receive an install program that upgrades the files on your disk, without destroying any of the information in your old dialing directory.

ProComm Plus is already well established, but this upgrade catapults a competent, easy-to-use communications program into a complete, robust, communications environment. Both novices and experienced users can benefit from such a well-thought-out, solid application. ■



ProComm Plus doesn't abandon the familiar command menu. But, if you hit Alt-Z twice you find yourself inside a complete context-sensitive help system.

First Looks

Ektaplus

CONTINUED FROM PAGE 33

250-sheet paper trays provide plenty of capacity, and the printer is smart enough to switch paper trays when one runs empty.

The printer also comes with two interface ports (one parallel and one serial) with room for two additional ports (parallel, serial, or AppleTalk). All ports are active simultaneously, and use the printer's internal memory to spool print jobs. You configure the printer emulation for each port separately. This means that you can hook the printer up to combinations of standalone PCs and LANs and let each computer speak its own language to the printer.

Other additional configuration features work well in the shared printer environment. You can set time-out intervals for each port in order for the printer to determine when a print job is complete. Each port can be assigned a name (our demo unit came with ports named for cities), and you can configure the printer to spit out a separator sheet each time a different port starts a print job. These settings are printed on the printer's startup status page, along with communications, paper handling, and emulation settings for each port.

There are a number of emulations from which to choose, as well. The base model, the 7016, includes HP LaserJet II, IBM 9-pin Proprinter, Epson FX-80, HPGL plotter, and Diablo 630. The 7016PS model we tested had the optional PostScript board installed at the factory. In addition to adding Adobe PostScript and the standard 35 font outlines, the board also adds a dedicated 68020 processor with 4MB RAM to the base model's 68010 processor and 2MB memory. You can upgrade the 7016 to the PS model on your own, by purchasing the \$1,995 PostScript option, but you save nearly 25 percent if you buy the PS model from the start.

Speed and a fine suite of design features are more than



The quality of the PostScript (left) and the copier output (right) is excellent. The 6-ppm convenience copier is limited to handling 8.5 by 11 sheets of paper; it doesn't do reduction or enlargement.



FACT FILE

Ektaplus 7016 and 7016PS
Eastman Kodak Co., 901
Elm Grove Rd., Rochester, NY
14653; 800-344-0006.
List Price: 7016 (base model),
\$5,495; 7016PS, \$6,995;
PostScript upgrade, \$1,995;
2MB memory upgrade, \$995;
serial port, \$95; parallel port,
\$95; AppleTalk port, \$195;
photoconductor drum, \$85;
toner, \$130.
In Short: Multifunctionality at
the right price. The Kodak 7016
is a 16-ppm laser printer that
supports multiple page
description languages,
combined with a built-in
convenience copier. The
7016PS adds PostScript to the
package.

CIRCLE 703 ON READER SERVICE CARD

enough to justify the cost of this printer, but Kodak's integrated copier adds tremendous value. The 7016 and 7016PS are not just printers; they are also copiers. Kodak calls the copier a "convenience copier" since it is only rated at 6 pages per minute, cannot handle sheets larger than 8.5 by 11, and cannot enlarge or reduce. As limited as its capabilities may be, it's still a welcome addition to the printing environment, and the output quality is excellent.

The best part is that you can make copies even when the machine is printing a job. Just open the top lid, put in your original, select up to 25 copies, and press

start. The machine will interrupt the print job (but continue to spool the job to its internal memory), make your copies, and then resume printing.

All this functionality comes in a surprisingly compact package. The printer is about 20 by 24 inches, and under 16 inches tall. At 85 pounds, it's no lightweight, but it's on par with other printers rated for similar speeds. The printer casing contains lots of thick sound insulation, which helps make it a nice neighbor in crowded work environments.

The 7016PS is not without its weak points, however. The print engine uses separate toner and drum components. Instead of a metal drum, it uses a flexible plastic film photoconductor belt (rated for 50,000 pages), which you must very carefully slide off a cardboard carrier onto a pair of metal rollers in the printer. There are too many opportunities to damage this belt, which also remains unprotected and exposed once mounted in the machine. Furthermore, the toner is quite expensive—\$130 for a unit that is rated at 4,000 pages. This is more than the cost of a Canon-based engine's cartridge that contains both the toner and drum.

We also encountered some problems in the various printer emulations. There were small glitches in the way nested macros are interpreted in PCL, and the PostScript mode had diffi-

culties when Ctrl-D characters were embedded in a print job. A Kodak representative claimed these problems had not been reported before, but that they would be investigated.

The printer also uses a "write white" technology, instead of the "write black" approach used by many other printers. The 7016PS images the page by charging the areas where toner is *not* supposed to be, instead of the other way around. The end result is that the printed characters tended to have thinner lines than when a "write black" approach is used. The printer comes with a software print utility that modifies PCL soft fonts to compensate for this effect.

Finally, the Kodak manual could use some attention. The setup instructions are clear, but the accompanying drawings have been sanitized to eliminate detail—so much so, that it's hard to identify the parts of the printer based on the drawings. Also, the sections regarding the different printer commands for the various emulations are so compressed and strangely organized as to be nearly useless.

Still, the Ektaplus 7016PS looks like a winner. The price compares favorably with the cost of buying two or three slower machines with similar capabilities, with the added bonus of a built-in copier. I expect that this half-hydra may be a full-blown hit. ■

First Looks

High Speed Redefined: Two V.32bis Modems

HANDS ON
by Rick Arye

Just when you thought it was safe to buy a high-speed modem they raise the stakes. Forval and U.S. Robotics both have designed V.32bis modems—modems with a base speed of 14,000 bps, theoretically capable of a maximum throughput of 57,600 bps. As we go to press, the CCITT hasn't formally approved the V.32bis standard, but both companies claim to meet the emerging specification (See sidebar—Forging a Standard: V.32bis).

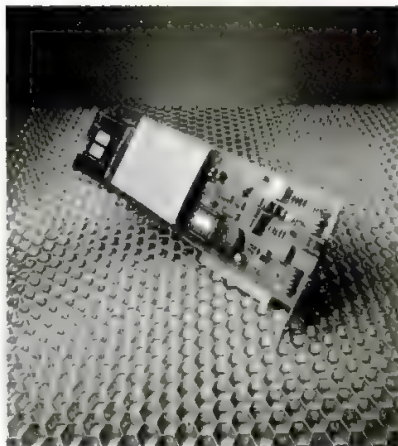
The Forval IM14400 internal modem takes up two slots on an ISA machine because the data pump for the modem is on a daughtercard. Forval also expects to ship an external, high-speed modem later this year. The U.S. Robotics's product is an external modem, the Courier V.32bis.

Both modems are fully compatible with earlier modulation schemes: including Bell 103 for 300 bps, Bell 212A and V.22 for 1,200 bps, V.22bis for 2,400 bps, and V.32 for 9,600/4,800 bps. Both ensure data integrity with V.42 and MNP error correction. Their incredible throughput is possible partly as a result of their support of V.42bis and MNP Level 5 data compression.

Forval and U.S. Robotics's V.32bis implementation is based on the Texas Instruments TMS320C25 chip. Both of these modems are rich in features. They both can operate in full- and half-duplex modes, operate synchronously as well as asynchronously, and support the basic Hayes AT command set. In addition, both modems can store user profiles and phone numbers in programmable nonvolatile memory.

But the abundance of features doesn't make these two modems any more difficult to use than other modems—if anything, they're even easier to use. The Forval IM14400 modem comes with a thin 50-page manual and the requisite command set summary card. It also ships with a specially licensed OEM release of *Communications by Crosstalk* from DCA. The program looks similar to *The Crosstalk Communicator*, but is preconfigured for the Forval modem. Since the program is already configured for optimum reliability and performance, the normal hurdles of specifying modem init strings and switch settings are bypassed. All you need to do is set the comm port jumpers and dial a number.

U.S. Robotics packages its Courier V.32bis modem with ample documentation including



The Forval IM14400 is an internal high-speed modem. A data pump on the daughtercard results in two used slots. Forval packages this V.32bis modem with preconfigured software for easy installation.

a command set summary card. Its default configuration is as close to plug and play as you're likely to find. This sleek black modem features 12 LED indicators across the front panel. Among the documents included with the modem is a Settings Supplement that lists the modem init strings and external switch settings.

Clearly these modems are screamers. Remember though, when it comes to modems, one is a lonely number. To take advantage of the high-performance features, one V.32bis

modem must call another. Alone or in a pair, both modems are premium products that carry premium price tags.

List Price: Forval IM14400, \$1,045. Forval America Inc., Modem Division, 28241 Crown Valley Pkwy., #H-440, Laguna Niguel, CA 92677; 714-347-0100.

CIRCLE 433 ON READER SERVICE CARD

List Price: U.S. Robotics Courier V.32bis, \$999. U.S. Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076-2920; 708-982 5010.

CIRCLE 434 ON READER SERVICE CARD

FORGING A STANDARD: V.32bis

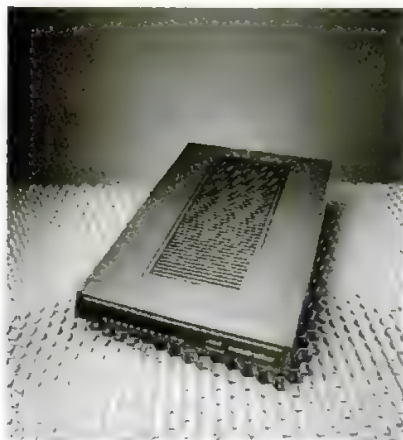
CCITT V.32bis, an extension to the original CCITT V.32 standard adopted in 1984, was unanimously adopted by the CCITT Study Group XVII on October 23, 1990. As of this writing, the standard was expected to be formally adopted in February of 1991.

V.32 defines 9,600- and 4,800-bit-per-second operations. V.32bis adds 14,400-, 12,000-, and 7,200-bps operations to the standard. Also, V.32bis includes on-line speed switching. Online speed switching allows two modems to negotiate changing data speeds by interrupting user data to request and negotiate a new speed. The alternative is hanging up and redialing, or resynchronizing (via handshaking).

Is V.32bis likely to change before it is formally adopted?

Probably not. So will it become a standard? It seems so. Two things are necessary to create a standard. First there must be a uniform implementation plan. V.32bis is such a plan. Second, enough modem users must adopt the plan, making it a compelling factor in purchase decisions.

V.32bis shows all signs of becoming a relevant standard. Manufacturers are rushing V.32bis modems to market. Virtually all major modem manufacturers have pledged to support V.32bis. And, manufacturers with V.32 modems, such as Hayes's ULTRA 96, are promising registered users an easy upgrade path to V.32bis. In addition, on-line services like CompuServe are endorsing the expansion of 9,600-bps access.—R.A.



The U.S. Robotics Courier V.32bis is an external high-speed modem with twelve LED front panel indicators. The modem has a base speed of 14,000 bps, and reaches a maximum of 57,000 bps.

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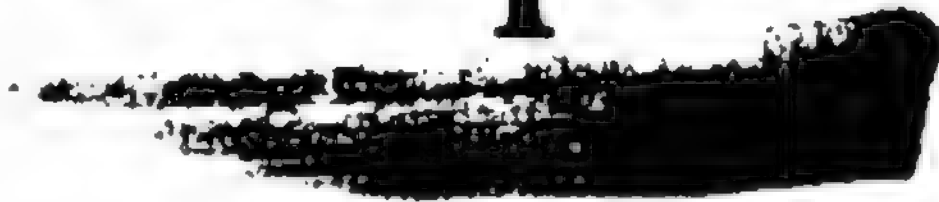
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First Looks

HP Unveils SCSI-2 Disk System in 486 File Server

HANDS ON
by Winn L. Rosen

Nowadays, any computer maker seeking legitimacy and profits offers a top-of-the-line tower based on the fastest available microprocessor (a 33-MHz 486) and a high-performance mass storage system.

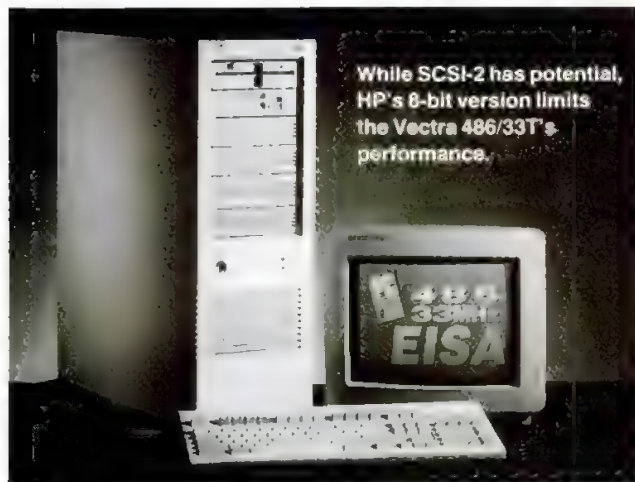
Hewlett-Packard adds a new twist to its latest server—the Vectra 486/33T—with one of the first implementations of a SCSI-2 storage system. SCSI-2 gives the Vectra the capability of handling up to 100 Unix terminals or 200 network nodes with the speed of a drive array but with none of the worries of a

proprietary technology.

As with other servers from major vendors, the Vectra is built like a minicomputer—a sturdy steel chassis clothed in plastic that stands 24.5 by 8.25 by 20.5 inches (HWD)—and priced to match. The base system equipped solely with a floppy disk drive and 4MB of RAM costs \$9,499. The minimal SCSI-2 system with a 440MB hard disk costs \$14,499, the same range as a similarly equipped Compaq Systempro or IBM PS/2 Model 95 486-based file server.

Despite its high-quality design and construction, the Vectra's microprocessor performance scores only in the middle of the 33-MHz 486 pack. It keeps up with the others but does not blaze ahead. On PC Magazine Labs' benchmark tests, even the Vectra's EISA-based SCSI-2 system is a disappointment—quick but little improved over ordinary SCSI disk systems on the EISA bus.

The reasons are twofold: DOS and the benchmark tests don't test SCSI's multitasking power, and Hewlett-Packard doesn't fully tap the capabilities of SCSI-2. However, Headland Technology's 16-bit Super



SMALL COMPUTER SYSTEM INTERFACE: Take Two

The Small Computer System Interface (SCSI) is an interconnection scheme for connecting peripherals of nearly any sort to PCs. Not just a disk interface, it's more like an extended expansion bus with its own control language and a parallel connection.

While the original SCSI design has been warmly received since its 1986 introduction, manufacturers have chosen to implement their own versions of its features. As a result, the first iteration SCSI has become more a point of departure than a standard, and matching SCSI components is more of a challenge than a certainty.

Enter SCSI-2. This revision to the spec should make the SCSI standard less open to

interpretation by individual manufacturers. It defines a common implementation for SCSI so that different manufacturers' products are more likely to work with one another. SCSI-2 also broadens the variety of devices explicitly supported by defining specific command sets for peripherals such as tape drives, CD-ROM drives, and other optical drives.

Most intriguing is the new performance potential of SCSI-2. The original SCSI specification specified an 8-bit connection that operated at 2MB per second asynchronously or 4MB per second synchronously.

SCSI-2 optionally extends the width of the SCSI bus to 16 or 32 bits and allows faster

synchronous speeds across the bus to boost the maximum throughput of the SCSI-2 bus to 40MB per second, even faster than the EISA bus (33MB per second).

SCSI-2 also supports tagged command queuing. This allows several commands to be downloaded to a SCSI-2 device and carried out in turn without any further host intervention. Drives no longer have to wait for the host computer to tell them what to do next.

So far no commercial PC products take advantage of all of these SCSI-2 innovations, but that gives the standard growing room and promises to make new product introductions even more exciting. —W.L.R.



FACT FILE

Vectra 486/33T

Hewlett-Packard Co., 19310 Pruneridge Ave., Cupertino, CA 95014; 800-752-0900.

List Price: With 4MB RAM, 170MB IDE hard disk, 1.2MB or 1.44MB floppy disk, \$11,249; with 440MB SCSI-2 hard disk, \$14,499; with 1,000MB SCSI-2 hard disk, \$17,799.

In Short: The Vectra 486/33T is in the same price range as a similarly equipped Compaq Systempro or IBM PS/2 Model 95, but the Vectra has one of the first implementations of a SCSI-2 storage system. The Vectra doesn't have blazing speed, but it should handle whatever job you give it.

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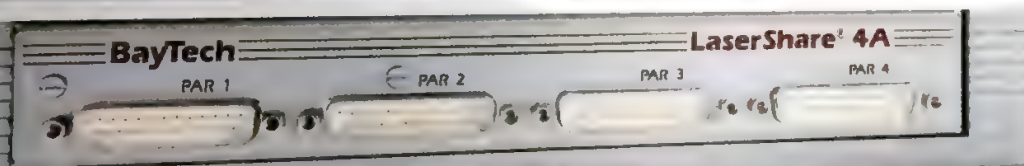
VGA adapter demonstrated excellent VGA compatibility and performance on par with the fastest in the industry.

The Vectra SCSI-2 system, based on an Adaptec 1740 SCSI-2 host adapter with special HP firmware, sticks with the 8-bit bus and slower transfer rate of the original SCSI spec. As far as performance is concerned, it advances to SCSI-2 only by using tagged command queuing (which is wasted on single-threaded DOS).

The stylish system holds eight full 32-bit EISA expansion slots and up to six half-height 5.25-inch drives. Four proprietary expansion slots come prefilled with a massive memory board capable of holding 64MB in 8MB SIMMs (1MB, 2MB, and 4MB SIMMs are also accommodated); a CPU board with 128K of external cache; an I/O board with one serial and one parallel port, and a second I/O board with a second serial port, plus mouse and keyboard ports. Floppy disk control circuitry for up to four drives and an IDE hard disk interface are built into the systemboard's circuitry. The 262.5-watt power supply automatically adjusts to any standard supply voltage in the world.

The Vectra 486/33T has everything it needs to be a workhorse server. While it doesn't stand out, it will likely stand up to whatever job you give it. ■

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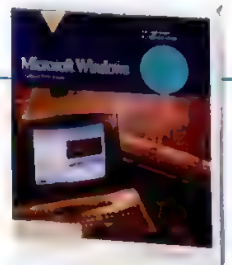
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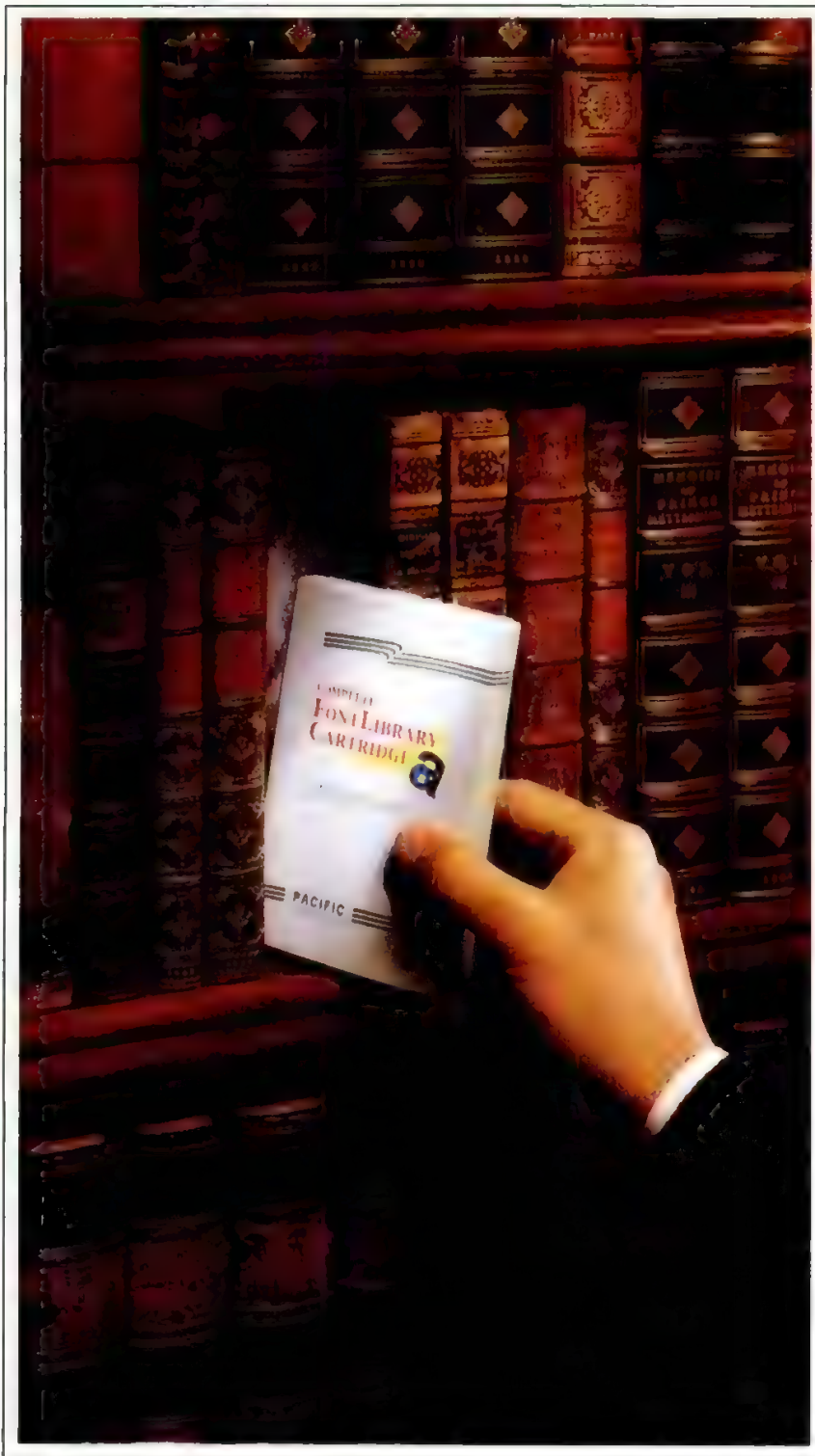
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First Looks

Santa Fe Media Manager Transforms Your Database into a Multimedia Experience

HANDBOOK
by David Hoffman

Many people are still trying to decide how to use multimedia in their lives; most don't feel like spending thousands of dollars on new hardware to find out. For those whose vision of multimedia focuses on the incorporation of images and sound into a traditional database, *Santa Fe Media Manager* (SFMM) provides the tools, and may even work with the hardware you've already got on your desk.

The \$595 SFMM is a flat-file database that integrates image display, audio playback, and text data. Each record can have a graphic and a sound file associated with it, treating each as a field in a table. When a record is displayed on-screen, the related image is shown simultaneously in a window, and you hear the sound segment that you've assigned to the image. A presentation can be created by showing all the records in sequence, or by limiting records based on search criteria.



FACT FILE

Santa Fe Media Manager
HSC Software, 1661 Lincoln Blvd., #101, Santa Monica, CA 90404; 213-392-8441.

List Price: \$595 for both the 8- and 16-bit versions.

Requires: 640K RAM plus 320K expanded memory, Super VGA card with 512K memory and monitor, DOS 3.3 or later. Mouse and extra memory recommended.

In Short: *Santa Fe Media Manager* is a multimedia software package that integrates pictures and sound with the elements of a traditional database. Images and sound are associated with text data and can be accessed individually, restricted by search criteria, or displayed in sequence as on-screen slide show presentations.

CIRCLE 707 ON READER SERVICE CARD

Thus, you could assemble a catalog of famous works of art, displaying an image of the piece along with the title, artist, and date. With the addition of an inexpensive sound board, a database of birds could include not only a picture, but a sample of the birds' calls. SFMM allows you to perform searches by specifying criteria on up to eight fields; so, for example, your art database could easily be restricted to French paintings from the 19th century.

SFMM sports its own graphical interface filled with soothing "New Mexico" colors. It works best when used with a mouse. Most of the functions are accessed from a single screen that displays the first nine fields of data in a record, the image associated with that record, and buttons that allow for manipulation of data. Picture files are assigned from this screen, and a simple paint utility is included for enhancing images. Sound recordings can be created using a microphone or other audio sources. Data records are accessed for viewing and modification with a mouse click. There are no keyboard shortcut keys, which sometimes forces you to do too much switching back and forth between keyboard and mouse during data entry.

SFMM imposes some restrictions on the way data is manipulated and displayed. When you add new data, records are always appended to the end of the table, and there is no way to sort them. For presentation purposes, the record order can be controlled by assigning numbers to each slide. Field names are limited to 14 characters, and only the first 22 characters of a field's contents can be viewed in the database window. Numeric data cannot be formatted with commas or a specific number of decimal places.

SFMM uses Borland's *Paradox* as its underlying database

format. It is not necessary to own a copy of *Paradox* since SFMM includes the tools to create a simple database from scratch, but if you need to make frequent updates to your textual data, you may be more comfortable working in the *Paradox* environment. The program also includes a utility for importing a comma-delimited text file from another data source.

SFMM will display graphics files that have been stored on disk in one of three formats:

graphics and sound files can take up a lot of storage.

You may want to invest in extra hardware to get the most out of SFMM; plenty of memory and a speedy hard disk will improve performance. A scanner or a video capture board is desirable for incorporating photorealistic images. Finally, while we reviewed the 8-bit version, a 16-bit version of the program is available with support for higher-quality Targa images, as well as the ability to control a VCR for displaying full-motion video.

A presentation is created by displaying records in sequence, much like a slide show. However, the program lacks transition effects, such as wipes and dissolves, between visuals. While



Santa Fe Media Manager displays a database record with its associated image and sound.

.PCX, .GIF, or .FLI. The .FLI format is created using Autodesk *Animator*, allowing SFMM to display animation in the picture window. The program outputs images at a resolution of 640 by 480 pixels, with up to 256 colors. Image access is fast, and the screen display is impressive.

All you'll need to run SFMM is an 80286-based PC, a Super VGA video card with 512K RAM and monitor, and 320K of expanded memory. SFMM supports the Sound Blaster card from Creative Labs, an add-in board that allows recording and playback of audio in digitized form on disk. You will also probably want plenty of available hard disk space, since

a presentation can be customized based on search criteria, there is no scripting language to allow for conditional branching based on user input. A utility is provided for distributing finished SFMM presentations without a license fee.

SFMM shows that multimedia can be useful without being frightfully expensive. The documentation is straightforward, and, though some operations are clumsy, the product is easy to use. SFMM's capabilities for putting together a polished presentation are modest compared with many full-blown authoring systems, but its strengths as a visual database tool make it appealing for many business and educational applications. ■

First Looks

Canon's Low-Cost Still Video Imaging Kit Suits DTP Needs

HANDS ON
by Thom O'Connor

Desktop publishers who hanker to enliven newsletters with in-house photography should consider the new Still Video Computer Imaging Kit from Canon USA. The kit offers a simple, affordable solution for capturing images and then converting them to file formats used by popular desktop publishing programs such as *PageMaker* and *Ventura Publisher*.

In a savvy marketing move aimed at the desktop publishing industry, Canon has bundled its three-year-old Xap Shot still video camera together with Digital Vision's venerable ComputerEyes digitizing board, image control, and file formatting software, and the necessary cabling to hook the pieces together. The result is a reliable, self-con-

ages onto a magnetic floppy disk. The industry-standard "VF" two-inch erasable floppy loads into a pop-up drive bay on top of the camera, and stores up to 50 images. To maximize quality, the Xap Shot records in the updated "high band" video mode for improved horizontal resolution. Power for all camera functions is provided by either a drop-in rechargeable battery, or an AC adapter, which is also the battery recharger.

The Canon Xap Shot behaves like any good point-and-shoot camera. It automatically meters ambient light, and the built-in flash compensates for dark shooting conditions. Its lens is prefocused, providing optimum subject sharpness from beyond 3.3 feet, and a macro mode switches the lens for close-ups from a distance of 12 inches. A \$70 Macro Frame



tained imaging kit, priced at \$899 for the black-and-white version, and \$1,099 for the more sophisticated ComputerEyes/Pro color version.

The kit's imaging device, the Canon RC-250 Xap Shot, is a fixed-lens still video camera about the size and shape of a well-packed sandwich. It uses a conventional lens in conjunction with its charge-coupled device image sensor to record im-



Canon's RC-250 Xap Shot (top) and Digital Vision's ComputerEyes digitizing board (bottom) team up to create an affordable imaging kit.



FACT FILE

Still Video Computer Imaging Kit

Canon USA Inc., Video Division, One Canon Plaza, Lake Success, NY 11042; 516-488-6700

List Price: \$899; \$1,099 for ComputerEyes/Pro color version.

Requires: 640K RAM, graphics adapter (VGA with color kit), and DOS 2.1 or later.

In Short: Canon's affordable RC-250 Xap Shot teams up with Digital Vision's ComputerEyes hardware and software for an affordable, easy-to-use still video image capture system well suited for midrange DTP users.

CIRCLE 709 ON READER SERVICE CARD

camera holder and an \$80 telephoto converter lens are available as options.

The ComputerEyes portion of the kit consists of an 8-bit digitizing board, which slips neatly into any available computer slot, and the EYES software. System requirements are few: 640K of RAM and a graphics display (VGA for the color version). Although the program works with a single floppy disk drive, once you start collecting images, you'll need hard disk storage space. (A single TIFF image file eats up about 307K of disk space.)

Unlike some other still video cameras, the Xap Shot includes built-in playback circuitry and a video output terminal, so you won't need an add-on disk player to export your video images. Captured images are sent to the ComputerEyes board via a garden-variety video cable, where

they can be digitized, displayed, and manipulated. The software for the color kit includes a preview window, allowing you to view images directly as they come from the camera. The black-and-white kit does not have this provision; you'll need a second, composite video monitor if you want to preview image composition and lighting.

The EYES software includes straightforward options for adjusting the brightness, contrast, and resolution levels of the system before capturing an image. You can further smooth, sharpen, and alter contrast of an image once it's digitized, and a high-contrast setting allows you to produce black-and-white line art instead of gray-scale images. With the color version of EYES, you can shrink, expand, flip, and invert images as well.

A black-and-white captured image can be transferred to disk in a variety of graphics file formats, including the TIFF format used in *PageMaker* and *Ventura Publisher*; *PC Paintbrush's* .PCX format; *Windows'* .MSP format; and the .IMG format for *GEM* applications. The ComputerEyes/Pro color version adds support for the Targa .TGA format and can generate both color and gray-scale TIFF files.

Taking into consideration the reasonable cost of Canon's kit, the images produced are quite good. The ComputerEyes board's capture resolution—which is independent of the computer's video display—can be set as high as 640 by 480 pixels, producing acceptably sharp and detailed images when printed using a standard 300-dot-per-inch laser printer. Output from a color printer or Canon's own Color Laser Copier 500 is also good.

Higher-priced still video cameras, such as Canon's RC-470—with its superior optics and higher resolution frame mode recording—produce sharper images; other image processing software, such as Microtek's *ImageStar*, offers more powerful image manipulation. But for simplicity, convenience, and price, Canon's Still Video Computer Imaging Kit is tough to beat. ■

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CA-SuperProject: New DOS Version Goes Graphical

HANDS ON
by Henry Perakowski

Computer Associates takes a giant step forward by solidifying its original two-product approach to project management and by giving the new product—now called *CA-SuperProject 2.0*—a graphical user interface. While it's still a DOS program, Version 2.0 has many of the features of *Windows* products, including pull-down menus, mouse support, dialog boxes, and interactive graphics. In addition, the new version has upgraded *SuperProject's* project planning functions and output facilities.

CA-SuperProject 2.0 replaces the former *SuperProject Plus* and *SuperProject Expert*, giving the user a single choice. However, this jazzier version of *SuperProject* has a much jazzier price—\$895. The *Plus* version of the product used to sell for \$395; the *Expert* version sold for \$695.

In contrast to earlier versions, the product has a streamlined and appealing look. When you start up *CA-SuperProject*

you proceed directly to a blank Gantt chart, whereas the previous version took you to a default screen with a columnar view of task and resource data. The screen background color for Version 2.0 is white, not black as in the earlier versions, and now there's a colored menu bar across the top of the screen. A message box at the bottom of the screen prompts you for a project name and lists some function key commands.

Similar to previous versions, Version 2.0 uses an outline format with indenting, even in the Gantt chart. In fact, despite the more graphical look, the general structure of many of the screens hasn't changed much. The bulk of the changes are stylistic—the use of color, borders, screen fonts, and pop-up dialog boxes with radio buttons.

The look of the Gantt chart bars and the PERT chart boxes has changed as well. The task bars on the Gantt chart are now solid bars, not the broken lines that were used in the previous versions. The PERT chart options offer a choice of box styles for different types of tasks. For

Task Name	Sched. Day	Task ID	Scheduled Start	Scheduled Finish	Pri	Alloc. Day
Assemble pipe	Sat	007	10/10/91 11:00a	10/14/91 7:00p	50	100%
Seal joints	Sat	008	10/17/91 11:00a	10/20/91 7:00p	50	100%
Test drain system	Sat	009	10/10/91 11:00a	10/10/91 7:00p	50	100%
TOTAL						

CA-SuperProject provides detailed information on each resource including resource type, task assignments, allocation, and costs. In this case, the details of resource management are tracked as the plumber's costs are prorated.

example, you can create milestones, rounded rectangles, diamonds, or ellipses.

In addition to the new look of the charts is the ability to manipulate their bars and boxes interactively. If you double-click on a task bar in the Gantt chart you can drag it left to increase its duration or push it right to shorten the duration.

The attractive look is carried over to the output. Printouts are WYSIWYG. In a sense, each screen view is its own report. The columns you choose to display, the data selected, and the totals all appear on paper as they do on-screen—even down to the colors, provided you have a color printer. Screen layouts can be saved and reused.

CA-SuperProject now has the ability to plan projects down to the minute, or by month and year. These are in addition to the hour, day, and week intervals implemented in previous versions. Several new task types have also been added: workday driven, effort driven, elapsed, span, and milestone. The program does fractional hour resource assignment and overtime scheduling as well.

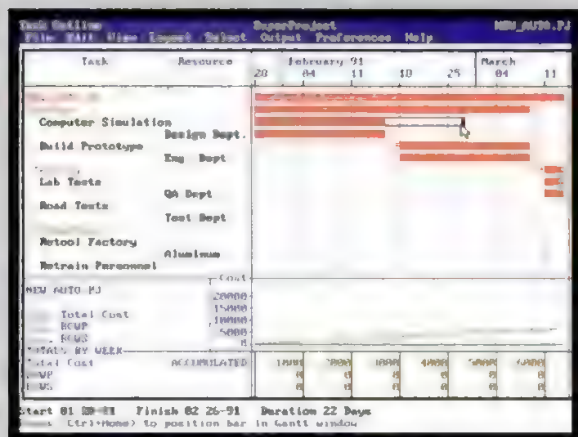
Other important new features are the addition of eight earned value fields to support CSSR and CPR government contract reports, a resource efficiency field, and resource leveling with or without overtime.

The new version includes the ability to have resources change over time in respect to the number of available units, the wage rate, and work hours. It can also categorize resources by labor, materials, production, and consumption.

The changes to *CA-SuperProject* don't cloud the fine qualities that made this a powerful and flexible project manager. You can choose between a beginner's mode of operation and several levels of expert mode, take almost complete control over the information shown on tasks and resources in the outline format, and precisely track the details of resource utilization and task completion. With the addition of an attractive graphical user interface plus its new functionality, the *CA-SuperProject* has stepped right up to meet the best competition available.

List Price: *CA-SuperProject 2.0*, \$895; owners subscribing to the SupportPlus plan or requesting the product up to May 5, 1991, will get the upgrade free; all other upgrades cost \$195. **Requires:** 640K RAM, hard disk, CGA, EGA, or VGA display, DOS 2.1 or later. Computer Associates International Inc., Micro Products Division, 1240 McKay Dr., San Jose, CA 95131; 800-531-5236, 408-432-1727.

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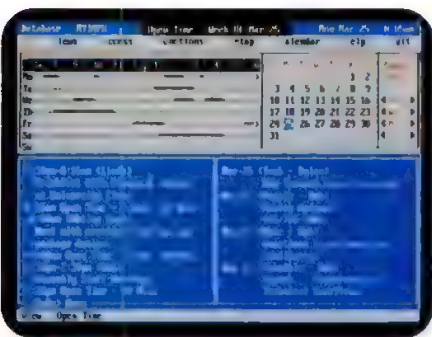
CA-SuperProject now has a graphical user interface that improves the look of the screens—especially the Gantt and PERT charts and the histograms. Now, all bars in a chart can be directly manipulated to change their durations.

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First Looks

ObjectScript Opens Windows for BASIC And C Developers

HANDS ON
by Richard Hale Shaw

Development systems like *ToolBook* and *Plus* address the *Windows* development needs of end users—provided they're willing to learn *HyperCard*-like languages. Programs such as *KnowledgePro* rely on a proprietary scripting language to deliver object-oriented *Windows* facilities. Unlike these other software packages, *ObjectScript* provides BASIC and C developers with an opportunity to get in on the act, too.

While the \$150 package isn't designed for end users, it's easy enough for most power users to become productive with it. You'll find that, like with *ToolBook*, you can design an interface using standard *Windows* objects: push buttons, list boxes, and picture objects. These can contain bitmapped or vector graphics or hypertext links between objects. You can designate what types of events—such as clicks or double-clicks—will activate an object, as well as which command or script to execute once activated.

Unlike the other development systems, *ObjectScript* contains nearly 50 built-in commands that can be used for creating an application without having to write a script. You can use these to display and hide objects, open and close windows, run programs from the disk, display messages, and load text and graphics from a file into an object. Other commands let you manipulate edit fields and windows, cut-and-paste to the *Windows* Clipboard, read and write *dBASE III+* files, and engage in DDE (dynamic data exchange) with *Microsoft Excel* and *Word* for *Windows*—all without writing a single line of code.

ObjectScript's language is a superset of BASIC. It's compatible with *Microsoft Quick-*

BASIC (the *Microsoft C* version of *ObjectScript* will be available approximately by the time you read this) and offers additional commands in order to manipulate the *Windows* Clipboard, engage in DDE conversations and call *Windows* DLLs (dynamic link libraries). There are also commands and functions to manipulate *dBASE* files (as well as the traditional BASIC file I/O facilities).

ObjectScript contains an editor and a compiler. You can associate commands with an object or, alternatively, you can assign a script to an object. All you need to do is insert "script" in the field where associated commands are placed. Then you enter and compile the script. Like the editor in *Plus*, script commands and control keywords can be easily inserted via pull-down menus, and the script compilation begins with a simple mouse click or keystroke.

ObjectScript won't let you create message handlers or send customized messages between objects, as in *ToolBook* or *Plus*. But *ObjectScript*'s functions

**FACT FILE**

ObjectScript 1.0
Matesys Corp., 900 Larkspur Landing Circle, #175, Larkspur, CA 94939; 800-777-0545, 415-925-2900.
List Price: *ObjectScript*, \$150; *ObjectScript Professional*, \$495.
Requires: 640K RAM, 4.5MB free disk space, *Windows* 3.0, and DOS 3.3 or later.
In Short: A *Windows* application development environment for developers who use BASIC or C. Though it's not an object-oriented system, it offers facilities for creating object-based applications using a robust command set.

CIRCLE 430 ON READER SERVICE CARD

and subfunctions are available throughout an application—you can call the functions in one object from another.

Creating menus and interfaces is easy. Rather than creating a script, you create a set of menu items. As you type, you merely indent the items that belong on the menu's pull-down, and attach commands or scripts to them; the menu is then complete. And *ObjectScript* contains tools to read the structure of a *dBASE* file and create a data-entry screen. This is probably the fastest way to create a menuing interface to *dBASE* with *Windows*.

Like *ToolBook* and *Plus*, the

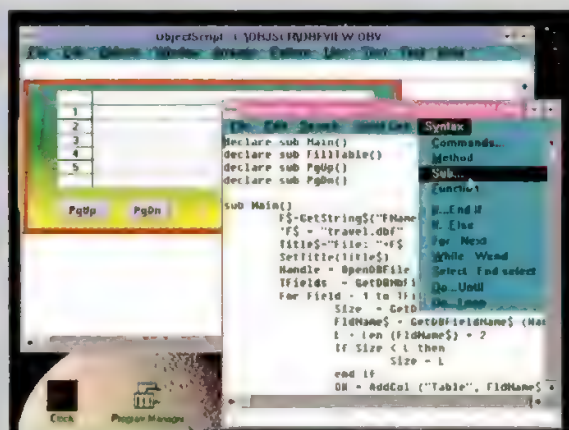
program offers a palette for making color selections, but you select tools and objects from pull-down menus. *ObjectScript*'s drawing facilities aren't as sophisticated as those found in *ToolBook*—but neither are they as complex. And there are no limitations on the size or the import speed of graphics as there are in *ToolBook*.

ObjectScript triumphs over the other packages when it comes to sample programs. *ToolBook*'s are too slow to be practical; *Plus*'s are useful, but uninteresting; *KnowledgePro*'s are virtually nonexistent. *ObjectScript* comes with more useful example programs than all the others put together—probably the best collection of sample programs I've seen.

Unfortunately, the program suffers from poor documentation. Sure, it's neatly typeset, but the document is out of sync with the program. Both the Quick Start and the sample program descriptions are often incorrect. Many of the sample files are missing, and some don't always behave as you'd expect. The program could also benefit from a few extra objects: scrollbars are not available independently of list boxes, and there is no support for combo-boxes.

Despite these problems, *ObjectScript* is an excellent value. A runtime version is royalty-free and included with the package. *ObjectScript* also comes with the *MiniAlbum*, previously available with Matesys' *Simple Win* (Reviewed, First Looks, September 26, 1989). And unlike many other development tools, *ObjectScript* can run efficiently in *Windows* real mode; a 286-based machine with 640K will do the trick.

Those who are looking for even more power should consider investigating the \$495 *ObjectScript Professional*—with field masks, data validation methods, and animation. *ObjectScript* doesn't claim *HyperCard* compatibility or similarity, but if you're a BASIC or C programmer and want to tap into the power of *Windows* while taking advantage of your language knowledge, you're going to love *ObjectScript*. ■

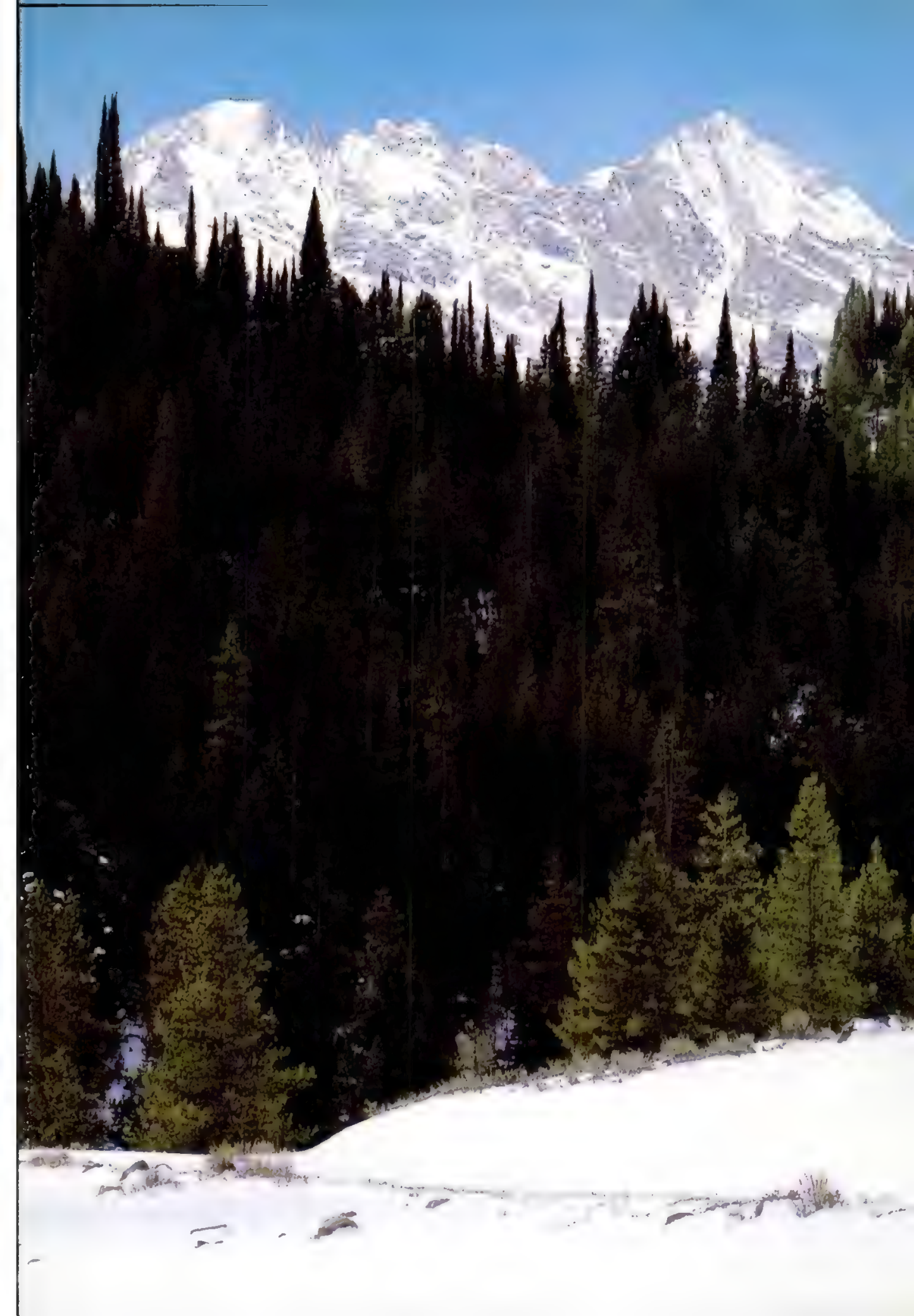


The *ObjectScript* compiler lets you select expressions and code constructs from a pull-down menu while creating a script.

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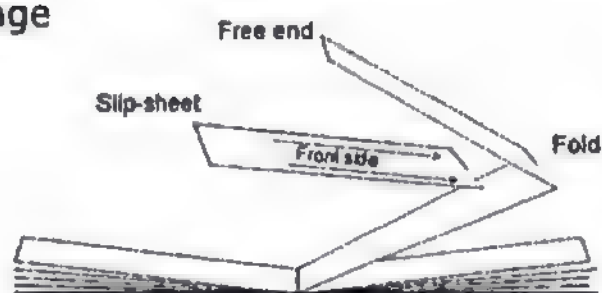
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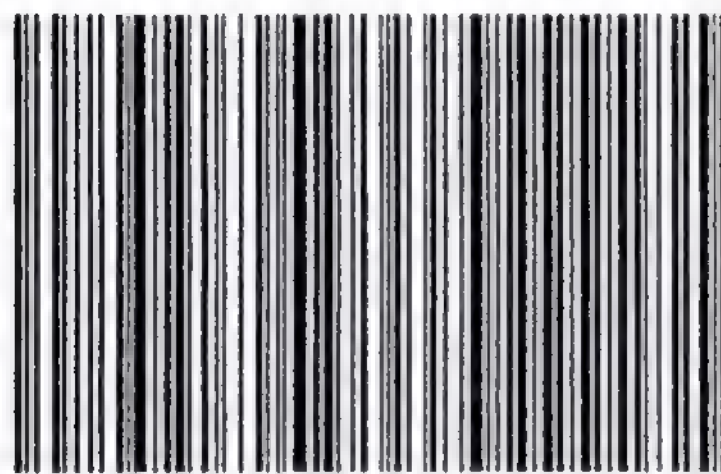


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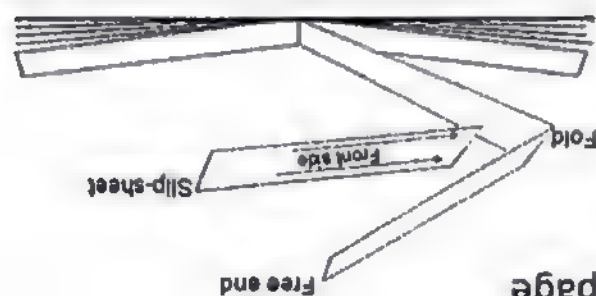


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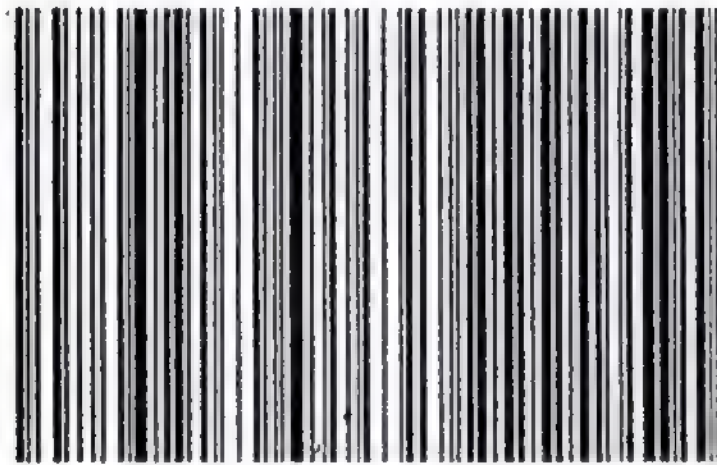
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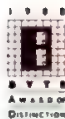
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First Looks

Who-What-When Enterprise Monitors Group Happenings



Chronos Software's *Who-What-When*, the popular PIM (personal information manager), has turned GIM (group information manager). *Who-What-When Enterprise*, Version 1.0, is a reworking of the standalone version. (See "Order from Chaos: PIMs Tackle your Desktop," November 27, 1990.)

Like its namesake, the new program lets individual users maintain personal calendars, card files, phone books, and to-do lists that keep track of important contacts and events. *Who-What-When Enterprise*'s greatest strength lies in its ability to reconcile this individual information with that of other users across the network. And while its interface is character-based and fairly mundane, the program is perfect for group scheduling, project tracking,

and shared resource management as well.

WWW Enterprise's new-found ability to coordinate individual data is based on its underlying Novell Btrieve database engine. If you use the product on a server with *NetWare 286*, you can install the Btrieve Value-Added-Process (VAP) and gain the efficiency of a database engine that presorts information before distributing it to network nodes. The software is versatile enough, however, to run on any LAN operating system. It uses only shared subdirectories and makes no special calls to the network operating system.

You can run *WWW Enterprise* in any PC with at least 386K RAM. A 32K TSR alerts you of appointments and important tasks even when you are in another application.

Using familiar tools that include a Rolodex-style card file, a calendar, a dialer, and project

tracking, *Enterprise*'s user interface ties together the three elements of group scheduling: who is associated with a task, what project the task is a part of, and when the task will be accomplished. User and contact information comprise the Who View, where you can also view a complete list of names and resources in the *WWW Enterprise* database. Projects are viewed, edited, or created in the What View. To see personal or office-wide calendars, you enter the When View, where you create to-do lists, with appointments, tasks, and deadlines.

The shared *Enterprise* calendar offers an immediate overview of the group schedule; a meeting-maker function helps resolve schedule conflicts at a glance, and a simple messaging function alerts those concerned. Simple Gantt charts provide a visual way of tracking projects.

WWW Enterprise's messaging facility allows users to create group mailboxes used to notify group members of deadline and project changes. The memo facility—a simple text editor—lets you send a date- and time-stamped message. Messages, which can include at-

tached text files, appear only on your personal calendar; there are no links to MHS or other e-mail systems. However, you can specify up to three hotkey combinations to invoke any DOS applications from within *WWW*.

The Reports menu allows you to print phone books, project calendars, and personal calendars on a full page or a junior legal size page that fits nicely into printed calendar systems such as "Daytimers." You can use your contact list to print mailing labels, and the program also has an autodial feature.

WWW Enterprise fits the niche for useful workgroup scheduling tools. It will appeal most to those already familiar with the standalone version. ■

List Price: *Who-What-When Enterprise*, single-server site license and six workstations, \$695; five additional users, \$495; 20 additional users, \$1,495.

Requires: 512K RAM in workstation, over 1.5MB RAM on server, DOS 3.1 or later. Chronos Software Inc., #240, 555 De Haro St., San Francisco, CA 94107; 800-777-7907, 415-626-4244.

CIRCLE 706 ON READER SERVICE CARD

LetrTuck Modifies Kerning Pairs



EDCO's \$99 *LetrTuck* lets *Ventura Publisher* users customize automatic kerning pairs—those subtle adjustments that remove excess space in two-letter combinations. Before *LetrTuck* arrived, you could modify or create kerning pairs only with hours of manual labor in a *Ventura* width table, where characters are referenced only by their ASCII numbers. You couldn't see the results of your changes until you reloaded *Ventura* and printed. *LetrTuck* running under *Windows 3.0* lets you see and adjust kerning pairs on-screen.

After loading a *Ventura* width table into *LetrTuck*, you choose a typeface family, such as Palatino, and all built-in kerning pairs appear on-screen. If you don't have a screen font to match the printer font, choose

a similar screen font. When you click on a kerning pair, the two characters appear in enlarged form, and you can adjust kerning either with the mouse or by entering a number in 1/1,000 of an EM unit.

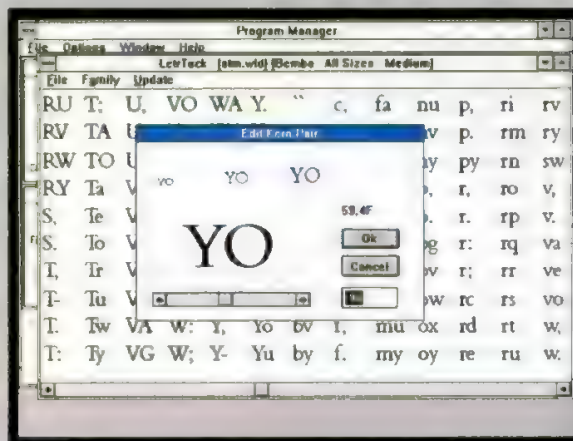
If some of your fonts don't come with automatic kerning pairs, transfer the kerning data from another font and then modify it, or use one of 24 kerning sets supplied with *LetrTuck*.

LetrTuck performs exactly as claimed, but its interface needs work. You have to remember to back up your width tables before editing, because *LetrTuck* doesn't have a "Save As" option that lets you save a modified table under a new name. The program is effortless to use once you learn its simple techniques, but the manual doesn't explain all of them. Don't press F1 for help, because the program doesn't offer any.

If you use the *GEM* version of *Ventura*, you can run *LetrTuck* as a character-based DOS program instead of a *Windows* application, but you won't get on-screen representation of kerning pairs. ■

List Price: *LetrTuck*, \$99. **Requires:** DOS 2.0 or later. EDCO Services Inc., 12410 N. Dale Mabry Hwy., Tampa, FL 33618; 800-523-8973, 813-962-7800.

CIRCLE 710 ON READER SERVICE CARD



LetrTuck adjusts kerning either by moving the slide bar or by entering a specific number of 1/1,000 of an EM unit.

First Looks

ForComment: Electronic Editing by Committee



PCs have profoundly changed the way documents are written, but when reviewing documents, the PC gets pushed out of the process. More often than not, proposals, reports, and the like are circulated manually rather than electronically.

ForComment from Access Technology brings the document review process into the PC age. The original program was released in 1987 and distributed by Broderbund Software, and it may well have been a concept ahead of its time. Version 2.0, just released, adds support for networked users.

The *ForComment* review process starts by importing an ASCII, *Microsoft Word*, or *WordPerfect* document. If you prefer, you can create a short document, up to about two pages, using the functional but limited built-in editor. You then create a distribution list.

ForComment allows different approaches to group document review. In the simplest, reviewers run *ForComment* on the same PC, adding their comments and notes. Or *ForComment* can create copies of the document for users working with non-networked PCs. In this case, reviewers run *ForComment* on their own systems, then return their commented copies to the author, who merges the commented versions into the master document.

In a Novell *NetWare* environment, *ForComment* is easier to use. When the author distributes a document, *ForComment* notifies the reviewers using the MHS mail service. Copies are made and merged into the master automatically. You'll need to know the reviewers' network user names before you start, because *ForComment* can't look them up. Only Novell networks are supported.

ForComment's character-

based user interface uses a Lotus-like two-line command menu along the top of the screen. Other operations are mapped to the function keys. During editing, the screen is divided into two windows. The top window shows the original document, and the bottom window displays comments or revisions for the line at the cursor.

ForComment lets you mark up your documents in three ways. You can attach a comment to a specific line, or you can suggest a revision for multiple lines. Your changes are made to a copy of the text, so the original lines stay intact. The third type of markup, the note-

pad, collects overall comments about the document. All reviewers have their own notepad, and can specify whether it is accessible to other reviewers.

A marked-up document can be printed in two different formats. One approach puts revisions in footnote form at the bottom of each page, while the other puts all revisions at the end of the document.

ForComment's approach is suitable for soliciting notes about content, but not for copy editing chores. Revising an entire line simply to insert a missing comma is distracting, and the program isn't conducive to doing simple things like cutting and pasting. Also, the small size of the screen windows makes it hard to get an overview of all the comments and changes. Printing helps, but unfortunately there's no way to have the comments appear next to their corresponding passages.

Where many simultaneous reviewers are involved, though, *ForComment*'s strengths outweigh its weaknesses. The group revision process virtually begs to be networked, and *ForComment* deserves praise for making this good idea a reality. It efficiently combines the suggestions and notes of many reviewers into a single document with a complete audit trail. If you are forever trying to incorporate revisions from a tall stack of marked-up draft copies, *ForComment* could be the key to ending your own personal paper chase. ■

List Price: *ForComment*, Version 2.0, \$1,295 per ten-user license, \$100 for each additional registered user. **Requires:** 640K RAM; 1.5MB disk space; DOS 3.0 or later. Access Technology Inc., 2 Natick Executive Park, Natick, MA 01760; 508-655-9191.

CIRCLE 432 ON READER SERVICE CARD

Monologue Reads Text Through Your PC's Speaker or Speech Accessory



With First Byte's \$149 *Monologue*, your PC speaker can do something useful instead of merely beeping at you. *Monologue* is a speech-generating utility that reads text from the screen or adds voice annotations to spreadsheets and other applications. For disabled users, it adds immeasurably to a computer's communications power.

Monologue's voice doesn't always sound like it knows exactly what it's talking about, but it's realistic enough to communicate most of what you want to say. It sounds a lot more plausible when used with any standard speech accessory like the Covox Speech Thing or Creative Labs' Sound Blaster. A surprisingly effective algorithm lets the program imitate the pitch changes of ordinary speech.

The program is a TSR that fills about 45K RAM if you have EMS, and 140K or more if not. While using any character-mode application, a hotkey (inconveniently definable only as an Alt-letter key) brings it to

life. After pressing it, you use the cursor keys or a mouse to define either a block of text or a spreadsheet cell, press Enter, and *Monologue* reads the contents. Pressing a function key lets it read the full screen, including status lines like *WordPerfect*'s "Doc 1 Pg 14."

The configuration program lets you build an exception dictionary for words that *Monologue*'s built-in algorithm can't handle. If you don't want the program to say "Chereel" use the exception dictionary to tell it to substitute "Sherril."

Monologue raises the pitch of a sentence that ends in a question mark, and says "quote," "unquote," "open paren," and "close paren" where the text on screen has quotation marks and parentheses.

You can change *Monologue*'s parameters on the fly using function keys, or permanently, with a configuration program. You can alter volume, pitch, speed, and the sex of the speaker. If you change the pitch from the default midlevel setting, the program uses a dull monotone.

A separate utility reads ASCII text files from the disk; you can use DOS wild cards to make it read multiple files with one command.

Monologue includes an optional device driver that lets you use macros to create voice annotations for spreadsheets. The macros write text to the device in memory, which translates the text for the speaker. You can also write BASIC or higher-level programs that speak by writing to the device. The manual says little about this, but it's not hard to puzzle out how to create voice annotations in word processors. The basic technique is to write a printer macro that prints to the *Monologue* device instead of the printer.

Monologue's manual is sparse, but the software has many possibilities. You can use this program wherever you want to interact with your computer audibly as well as visually. ■

List Price: *Monologue*, \$149. **Requires:** 512K RAM, DOS 3.0 or later; supports all standard speech accessories, but can be used with computer's internal speaker only. First Byte, 3100 S. Harbor Blvd., #150, Santa Ana, CA 92704; 714-432-1740.

CIRCLE 431 ON READER SERVICE CARD

Quick, name the world's best memory manager:

NETROOM!

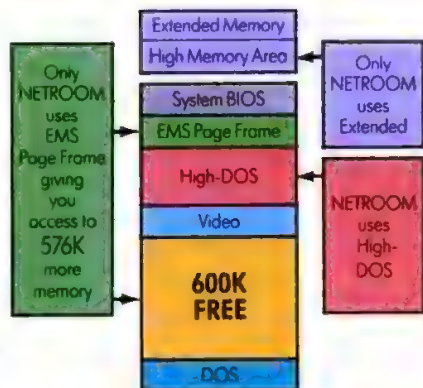


Right!

If you thought the answer is QEMM® or 386MAX®, think again. Because **NETROOM**® just beat them both, by winning PC Magazine's prestigious Editors' Choice award.

PC Magazine said: "With its versatility, this \$149 four-user version rates as a real winner. Considering **NETROOM**'s price and capabilities, you will find that there is no second choice."

What makes **NETROOM** a winner is that it is more than a great LAN manager. It is a full-featured memory manager that not only relocates LANs (like Novell, VINES®, etc.), it also moves device drivers, and TSRs into extended, expanded, and high-DOS memory.



Features:	NET-ROOM	QEMM	386 MAX
Windows 3.0 support	✓	✓	✓
Multuser license	✓		
Converts Ext. to Exp	✓	✓	✓
Relocates to High-DOS	✓	✓	✓
Relocates to LIM 32 Frame	✓		
Relocates to Expanded	✓		
Relocates to Extended	✓		
Works on 386/486	✓	✓	✓
Works on 8088/286	✓		
Memory Analysis Utility	✓		

And, **NETROOM** is the only memory manager that runs on all PCs (8088 through 80486).

But, there's more...PC Magazine says it's "The most flexible product we tested,"...and..."**NETROOM** uses a unique swapping feature to access data and programs in extended or expanded memory...Even PCs with tightly jammed high-DOS areas can benefit from the memory swapping capabilities of **NETROOM**."

And to top it all off, with **NETROOM** you will get absolutely **FREE-DISCOVER**®, an excellent utility that makes installation a pleasure and provides a detailed, real-time view of the memory configuration and

CIRCLE 313 ON READER SERVICE CARD



possibilities within a PC.

PC Magazine says "Netroom's \$149 price for four users is a steal." So, go out and steal yourself a copy!

Available from Helix or at your local dealer.

Requirements: A 386, or some EMS 3.2 or EMS 4.0 memory hardware, or at least 64K ext. memory and DOS 3.3 or greater



1-800-451-0551



*Single User, 4 User \$149, 10 User \$249 plus \$5 per order shipping & handling

HELIX SOFTWARE COMPANY

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The power planner the competition didn't plan on.

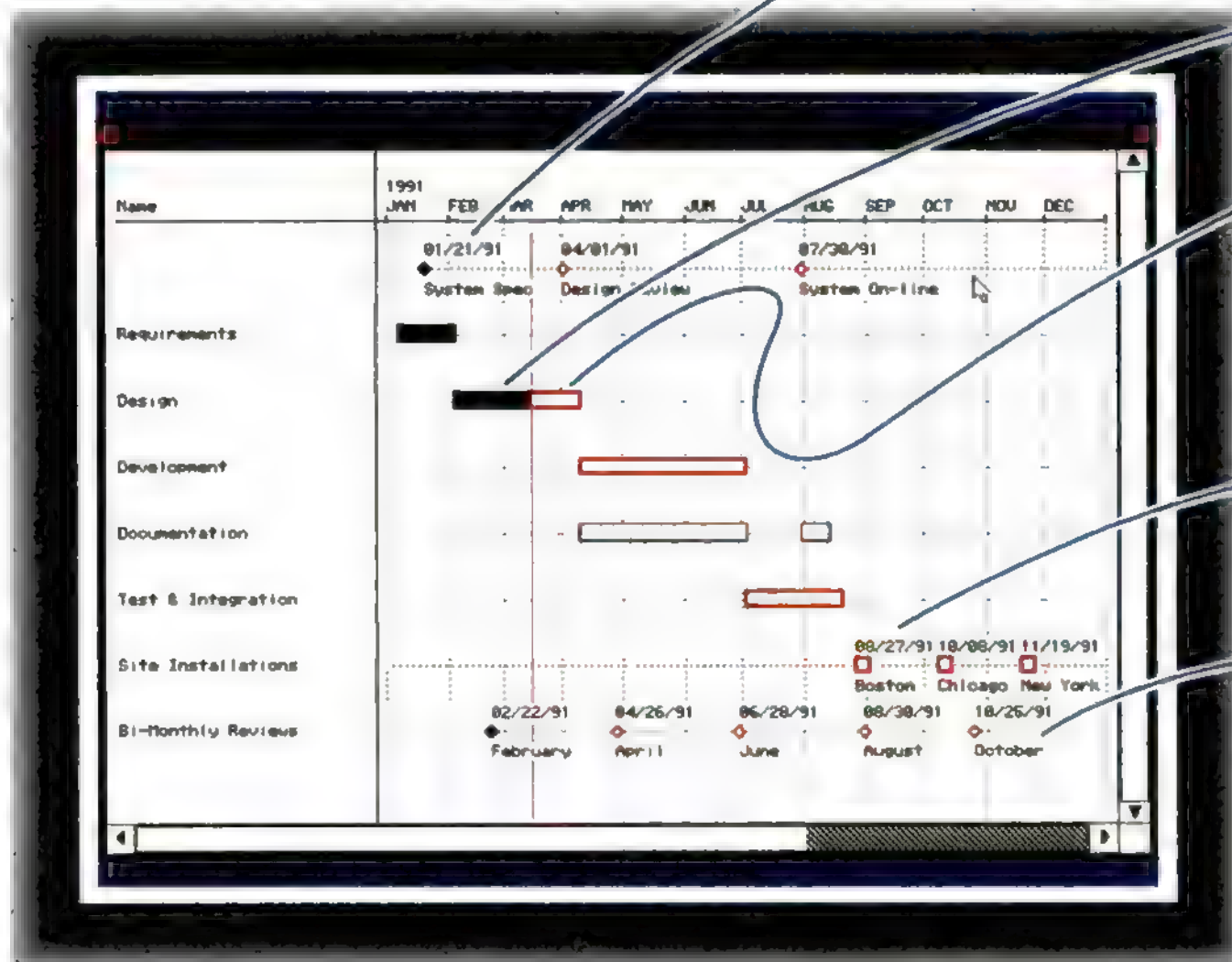
Announcing Project Scheduler™ 5. The difference is still graphically clear.

Impressive new features and a highly intuitive graphic interface make Project Scheduler 5 the easy-to-use project management software the competition just can't beat. Why? Because critical project information is easier to understand — and instantly available — at every level of detail.



Key milestones of your choice, such as completion dates, checkpoints on progress, and major accomplishments, are summarized across the top of your schedule for an instant overview of project status.

Gantt chart shows you more of what you want to see.

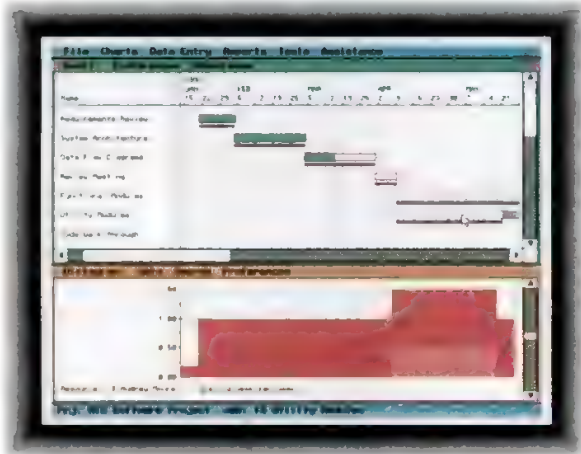
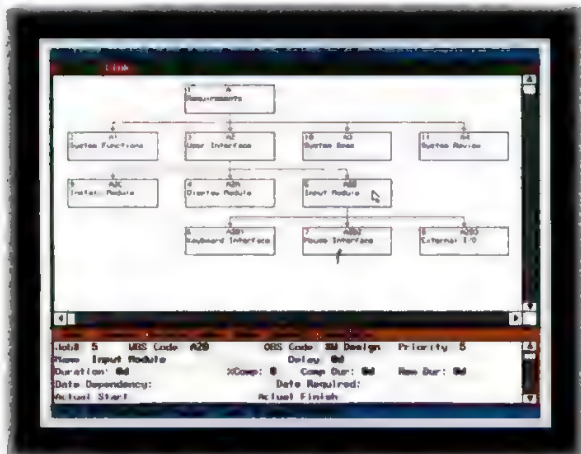
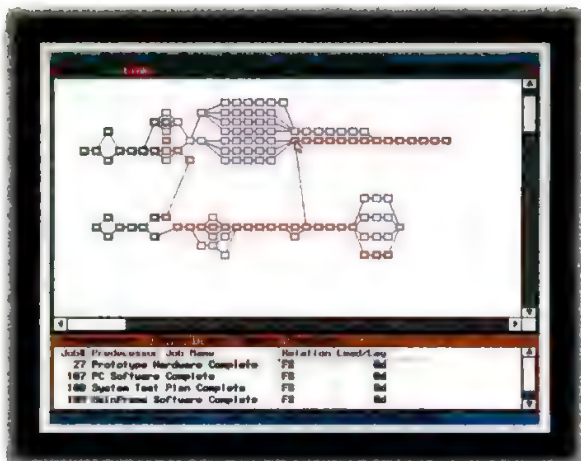


Shaded areas illustrate "percent complete" for each job.

The critical path is always clearly visible, indicated by a heavy red outline.

You can annotate your chart with information such as when and where an event takes place, even at summary levels.

Information can be categorized and labeled — all on the same line — maximizing vertical screen space and helping you create tighter, crisper presentations.



● **Flexible zoom options (top).** Project Scheduler 5's network diagram gives you an easy-to-read overview of dependencies at five selectable zoom levels. It also lets you define links across projects within and across work groups.

● **Organizational tree structures (middle).** Tree structures let you easily organize your project by both Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS) codes. This dual organization capability lets you tailor the structure and reporting of your project to fit your unique needs. You can create codes from your tree, or create the tree from your codes—whichever is more convenient.

● **Interactive and automatic resource leveling (bottom).** By leveling resources interactively using a resource-filtered Gantt with the resource histogram in the lower window, you can quickly pinpoint overloads and make adjustments. With automatic resource leveling, the schedule is adjusted to fit within specified availability limits for each resource.

Feature	Project Scheduler 5	Microsoft® Project for Windows*	Time Line® 4.0
Project planning and tracking	•	•	•
Gantt and network charts	•	•	•
Work group project connectivity	•		
Tree structures	•		•
Staffing profiles	•		
Cost curves	•		
Cost inflation modeling	•		
True PERT analysis	•		
Batch reporting facility	•		
Graphical user interface	•	•	

Integrated work group project connectivity.

With Project Scheduler 5, work group project connectivity is no longer just an idea. Because now you can accurately define dependencies among independent project files. Projects can be viewed at the individual or group level. Full data integrity is maintained because all schedule commitments are generated from an integrated validated group-level network.

The features you really need.

Convenience features such as WBS and OBS tree charts viewed with selectable zoom levels make organizing and presenting project information a breeze. Annotated Gantt charts let you see more information on screen at the same time, and produce more concise presentations. Financial cost curves plot anticipated costs versus actual costs to date. And a new batch reporting facility makes periodic report generation fully automatic.

Results you can clearly see.

Best of all, Project Scheduler 5 charts and reports contain precisely the information you need—summarized at a higher level for executives and board members, or selectively summarized and filtered to highlight individual project parts.

With Project Scheduler 5, planning your projects has never been easier. For more information and a brochure, call or write:

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by
Cristina Córdova
and Nate Zelnick

New & Improved

News of Announced Products and Upgrades

MultiScope Delivers Debugging Tool for DOS Applications

NEW The *MultiScope Debuggers for DOS* contains Run-Time, Post-Mortem, and Remote debuggers that allow you to debug DOS applications. They operate under both the Windows graphical environment and the standard PC character-mode environment. *MultiScope* provides several variations of each debugger for supporting different memory and machine configurations, from a standard 640K PC to a fully loaded 486-based machine. The debuggers support all compilers with *CodeView* or compatible debugging information.

The Run-Time debuggers provide you with several views into the runtime operation of your program. They let you control the execution of your program by using watchpoints, or breakpoints. You can also view and modify raw memory as well as the CPU and math coprocessor registers.

Post-Mortem Debuggers let you symbolically analyze the state of your program after it has crashed. When a runtime error occurs, a dump file is created that you can examine to pinpoint the cause of the crash.



The *MultiScope Debuggers*' graphical data window displays data structures.

A 15K Remote Debugging system, either serial or network-based, enables a transfer of the target machine's resources to the application being debugged. In addition, a dual-monitor feature allows you to use the debugger on a secondary monitor while keeping the application screen undisturbed on the main monitor. **List Price:** *MultiScope Debuggers for DOS*, \$179. **Requires:** 640K RAM, 3MB of available hard disk space, DOS 3.3 or later. *MultiScope Inc.*, 1235 Pear Ave., #111, Mountain View, CA 94043; 415-968-4892.

CIRCLE 442 ON READER SERVICE CARD

HOT PROSPECT

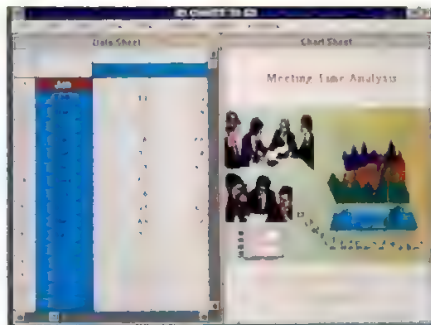
3D CHARTS TO GO! CREATES TRUE THREE-DIMENSIONAL CHARTS AND GRAPHS

If you're looking for a Windows 3.0-compatible, 3-D chart and graph maker, **BLOC Publishing** has designed *3D CHARTS To Go!*. The \$99 program creates 3-D pie, bar, area, and line charts. Each can be displayed in Perspective, Isometric, or Oblique views and may be rotated, sized, or moved.

3D CHARTS To Go! allows you to graph data from *Excel*, *Wingz*, and other Windows software into the program without exiting those programs. The auto-import function imports from *Lotus .WKS* files. The program also supports .WMF, .PCX, and .BMP file import formats, so predesigned clip-art images can be added to charts. A split-screen feature allows you to see the data while producing the chart. Compatible with any Windows-supported printer, *3D CHARTS To Go!* features a presentation mode that can present a "slide show" of charts for use in conjunction with the printed versions.

List Price: *3D CHARTS To Go!*, \$99. **Requires:** 640K RAM, Windows 2.0 or later. **BLOC Publishing**, 800 SW 37 Ave., #765, Coral Gables, FL 33134; 305-445-5010.

CIRCLE 441 ON READER SERVICE CARD



3D Charts To Go! lets you see the data while producing the chart.

Intel's 72-Pin SIMMs Increase System Memory by Up to 4MB

NEW The growing popularity of high-performance software applications and sophisticated operating systems has increased the demand for PC memory. To accommodate this demand, **Intel** has designed its Matched Memory product line. The first module in this series is a 72-pin SIMM (single in-line memory module) that plugs directly into a socket on the PC's motherboard, leaving expansion slots free for other enhancement products such as a modem or PC fax board. Intel's 72-pin SIMMs are available in several versions—a 1MB version for \$225, a 2MB version for \$445, and a 4MB version for \$945. They are each compatible with select Compaq, Hewlett-Packard, IBM, and Zenith computers.

List Price: 72-pin SIMM, 1MB, \$225; 2MB, \$445; and 4MB, \$945. Intel Personal Computer Enhancement Operation, 5200 NE Elam Young Pkwy., Hillsboro, OR 97124-6497; 800-538-3373, 503-629-7354, or 503-629-7000.

CIRCLE 443 ON READER SERVICE CARD

New Memory Expansion Board Adds Up to 32MB To Micro Channel PCs

NEW Another solution to the large memory requirements of today's sophisticated software and multitasking operating systems is **Computer Elektronil Infosys of America's** new memory adapter. The MegaRam is a full-length memory expansion board for 16- and 32-bit Micro Channel computers. With a memory capacity up to 32MB, the MegaRam board also supports configurations of 4MB, 8MB, and 16MB. When running in a 16-bit slot, the board automatically reconfigures itself to 16-bit mode.

In addition, the MegaRam board supports the Micro Channel streaming mode, which writes data directly into the memory locations at high speeds and automatically updates memory addresses.

List Price: MegaRam, \$495. **Computer Elektronil Infosys of America Inc.**, 512-A Herndon Pkwy., Herndon VA 22070; 703-435-3800.

CIRCLE 444 ON READER SERVICE CARD

BRIEFS

**ANTI-VIRUS
Systems Peripherals'**

immunizer, ThunderByte, is both hardware- and software-based. Automatically activated, ThunderByte detects viruses that are already present and prevents others from corrupting files. 508-535-6196.

**MONITORS**

American Mitac is shipping a Super VGA, low-emission, 14-inch color monitor. Priced at \$795, the Mitac L1420 offers 1,024-by-768 interlaced resolution. A new deflective yoke cuts down emissions. 408-432-1160.

Falco Data Products' FVP Super VGA monitor retails for \$355. With resolutions up to 800 by 600 (noninterlaced) and 1,024 by 768 (interlaced), the FVP monitor has a dot pitch of 0.28 millimeters. 408-727-0351.

Nanao USA Corp. has announced the 20-inch FlexScan 9400i (\$3,899) and the 12/14-inch FlexScan 9080i (\$1,929), two low-radiation monitors featuring intelligent microprocessors for memorizing on-screen application settings. Both operate at 70 Hz for reduced flicker at resolutions up to 1,280 by 1,024 noninterlaced. 800-235-2202, 213-325-5202.

Monitorm Corp. has unveiled the Viking 21/91 C, a 21-inch, 256-color monitor and controller package with resolutions of 1,280 by 960 (noninterlaced). Priced at \$3,095, the bundle contains drivers for AutoCAD, Windows 3.0, and other popular programs. 612-933-5701.

Sony's new 20-inch Multiscan HG monitor displays Trinitron color graphics with resolutions up to 1,280 by 1,024 (noninterlaced) on multiple computer platforms and costs \$4,000. 408-944-4225.

Taxan USA has introduced a pair of color autoscanning monitors that utilize Trinitron CRT technology. The 14-inch MULTIVISION 795, at \$1,095, displays resolutions up to 1,024 by 768 (noninterlaced). The ULTRAVISION 1095 20-inch monitor, for \$4,735, displays resolutions up to 1,600 by 1,200 (noninterlaced). 408-946-3400.

Floppie Librarian V Manages Your Disks

NEW Designed to eliminate time-consuming searches through stacks of disks, **Stuart-Matlock Corp.**'s new database management software, *Floppie Librarian V*, promises to lead you directly to the disk you need. Multiple search modes locate disk files by disk name, filename, user code, category, and other disk descriptions. User-defined filing categories permit customization of records.

The menu-driven, disk inventory manager handles up to one million disks that it numbers sequentially. It allows you to add, browse, categorize, delete, edit, print, search, and sort these disks. A Memopad, with a 65,000-character capacity, lists directories, filenames, comments, file size, and creation time and date. *Floppie Librarian V* also automatically calculates available disk capacity.

Other features include a report and label print utility. A utility option enables you to back up database files, reindex previously deleted recall records, "pack" the database, and alter display colors.

List Price: *Floppie Librarian V*, \$59.95.

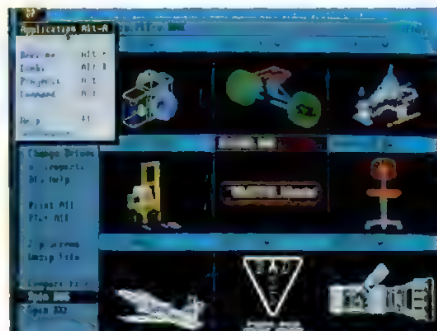
Requires: 512K RAM, hard disk, and DOS 2.0 or later. Stuart-Matlock Corp., P.O. Box 541, Mt. Laurel, NJ 08054; 609-866-7699.

CIRCLE 445 ON READER SERVICE CARD

SoftSource Puts a Spin On AutoCAD Drawings

NEW Designed as an AutoCAD enhancement, **SoftSource's** *DRAWING Librarian Professional* comes fully equipped with *AcroSpin*, a high-speed 3-D graphics animator. The *DRAWING Librarian Professional*, priced at \$500, is a drawing management package for linking and red-lining drawings. Its translation capabilities make AutoCAD drawings available in most CAD environments.

The *DRAWING Librarian Professional* includes a script language for system control. These script programming abilities are used to closely integrate *AcroSpin* into the package.



The *DRAWING Librarian Professional* translates AutoCAD drawings.

AcroSpin allows you to view and rotate 3-D .DXF and .DWG images in any orientation at any speed—even large drawings, including solids created in AutoCAD, Release 11, and AME. You can also toggle layers on and off to display specific parts of a design, or rotate individual blocks for design checks. *AcroSpin* requires no memory overhead.

List Price: *DRAWING Librarian Professional* with *AcroSpin*, \$500. **Requires:** 640K RAM, DOS 2.0 or later. SoftSource, 301 W. Holly St., Bellingham, WA 98225; 206-676-0999.

CIRCLE 446 ON READER SERVICE CARD

AutoCAD Scaling: Keep It Simple

NEW As its name suggests, **KIS Software's** new *KIS Scaling* software program tries to KIS (keep it simple). Priced at \$100, it comes complete with pull-down menus and provides a complete AutoCAD menu with an option to insert a custom Mini-Menu at a user-selected pull-down location.

KIS Scaling provides various ways to mix and match various drawings at different scales. It sets up all new drawings with correct size text, arrows, line-type scale, and some dimensional variables. The software also allows you to make scaled detail drawings from within a drawing. You can then insert these drawings into the main drawing scaled up or down (without any calculations or charting).

KIS Scaling displays all of the editing and works at full scale with true values. A scaling macro simplifies the procedure for changing a drawing or a detail. When the drawing is complete, you can scale it down to 1:1 for plotting.

List Price: *KIS Scaling*, \$100. **Requires:** AutoCAD. KIS Software Inc., P.O. Box 663, Pearisburg, VA 24134; 800-833-4KIS.

CIRCLE 447 ON READER SERVICE CARD

NEC Monitor Sports Reduced Magnetic Field

NEW The MultiSync 3DS from **NEC Technologies** provides the same features as its sibling, the MultiSync 3D, while also incorporating NEC's Reduced Magnetic Field (RMF) technology. NEC achieved this RMF version through additional shielding, a cancellation yoke, and grounding wires that are incorporated into the monitor construction. The 14-inch color monitor displays resolutions up to 1,024 by 768 in interlaced mode, up to 800 by 600 in noninterlaced mode, and supports analog graphics formats, including 8514/A, VGA, Super VGA, and IBM's new XGA standard. **List Price:** MultiSync 3DS, \$1,099. NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; 708-860-9500.

CIRCLE 448 ON READER SERVICE CARD

REPORT CARD **INFO** **WORLD**

SPREADSHEET SOFTWARE

Quattro Pro
VERSION 2.0

Criterion	(Weighting)	Score
Performance		
Formulas analysis	(100)	Very Good
Compatibility	(50)	Excellent
Speed	(75)	Very Good
Database	(75)	Excellent
Graphics	(50)	Good
Output	(50)	Excellent
Macros		
Consolidation linking	(50)	Excellent
Capacity	(75)	Excellent
Documentation		
Ease of learning	(50)	Excellent
Ease of use	(100)	Very Good
Error handling	(50)	Very Good
Support		
Support policies	(25)	Satisfactory
Technical support	(25)	Satisfactory
Value	(100)	Excellent
Final score		8.7

SPREADSHEET SOFTWARE

Lotus 1-2-3
VERSION 3.1

Criterion	(Weighting)	Score
Performance		
Formulas analysis	(100)	Good
Compatibility	(50)	Excellent
Speed	(75)	Good
Database	(75)	Very Good
Graphics	(75)	Very Good
Output	(50)	Very Good
Macros	(50)	Good
Consolidation linking	(50)	Excellent
Capacity	(50)	Good
Documentation		
Ease of learning	(50)	Excellent
Ease of use	(100)	Satisfactory
Error handling	(50)	Very Good
Support		
Support policies	(25)	Very Good
Technical support	(25)	Satisfactory
Value	(100)	Satisfactory
Final score		6.7

Borland's Quattro Pro is the best spreadsheet.

Quattro® Pro 2.0

"Quattro® Pro provides more features and better performance than 1-2-3..."

BYTE, November 1990

"Quattro Pro offers some of the most powerful charting and best-quality output you'll see in a spreadsheet today."

PC Magazine, December 1990

"Overall, Quattro Pro has the best set of database features we've seen in a spreadsheet."

InfoWorld, December 1990

"Quattro Pro 2.0 also offers more interactive presentations, a more flexible desktop environment and smaller RAM requirements."

PC Week, October 1990

Lotus® 1-2-3® r 3.1

"... only masochists need to try [1-2-3, Rel. 3.1 on a 1Mb machine]. Performance was so sluggish on a 1Mb Compaq 386+/20 that we gave up after half an hour."

InfoWorld, October 1990

"... it [Lotus 1-2-3 Release 3.1] doesn't have everything you expect from a graphical interface..."

PC World, September 1990

"...(1-2-3's) WYSIWYG module has little knowledge of what is going on in the primary program..."

PC Week, October 1990

"While the division of labor is mostly logical, it makes [Lotus 1-2-3's] system feel like exactly what it is: a patchwork."

PC Magazine, December 1990

Lotus users! Save \$395 off Quattro Pro 2.0! If you own Lotus 1-2-3, you can upgrade to Quattro Pro 2.0 for only \$99⁹⁵! This includes our 60-day, money-back guarantee. Order today! See your dealer or CALL NOW 1-800-331-0877

CIRCLE 285 ON READER SERVICE CARD

B O R L A N D

Makers of Paradox®, Quattro® Pro, Turbo C++, Turbo Pascal® and Sidekick®

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CODE M838

QUATTRO PRO 2.0



BRIEFS

CONTINUED FROM PAGE 56



GRAPHICS

Boca's Basic VGA board lists for \$89. The 16-bit board displays 800 by 600 by 16 colors with its 256K RAM. The Basic VGA is jumper- and switch-free for easy installation. 407-997-6227.

Everex has priced its new VGA card at \$98. Designed for easy installation, the Viewpoint Standard automatically configures itself for an 8- or 16-bit slot. 800-628-3837, 415-498-1111.

Monolithic Systems expands its video controller line with a high-resolution Ultra VGA option for its MicroPAQ 452 VGA/multifunction board (\$725) and the lower-end MicroPAQ 451 VGA/multifunction board (\$465) with Super VGA capabilities and an optional SCSI interface. 303-790-7400.

Image Processing System has added three new high-resolution graphics adapters to its Overview family. Based on the 82C480 graphics processor, the Overview cards are 8514/A-compatible. The \$695 Overview 1024 offers an optional anti-aliasing RAMDAC. On the high end, the Overview 1024/32, a 32-bit true-color card, displays resolutions of up to 1,024 by 1,024 for \$1,895. 416-940-0300.

Colorgraphic's new Single and Dual VGAMC (\$375 and \$750) graphics adapters, designed for Micro Channel computers, provide a debugging tool for CodeView users. They allow you to display graphics simultaneously on two separate monitors. 404-455-3921.



OPTICAL STORAGE

Dynatek Automation Systems has introduced a 654MB

Multifunction Optical Drive subsystem, the DynaTek MFD600. Priced at \$4,995, the SCSI drive provides read, write, and protect capabilities by accommodating both WORM and rewritable (magneto-optical) media. 416-636-3000.

Storage Dimensions added a 650MB erasable optical subsystem to its product line. The new 5.25-inch subsystem meets ANSI/ISO standards and sells for \$5,495. 408-879-9330.

CAT Increases Hand Scanner Portability

NEW Finally, there is a link between laptop computers and hand-held scanners. **Computer Aided Technology** has increased the portability of hand scanners with a \$149 adapter that measures 0.8 by 2.3 by 4.7 inches (HWD) and weighs 5.7 ounces. The CAT Hand ScanAdapter LPT is a pocket-size external interface that allows your existing scanner to operate via your computer's parallel port. It doesn't use a scanner control card. The adapter supports The Complete Hand and Half-Page scanners, DFI Handy Scanners, Geniscan hand scanners, Logitech ScanMan scanners, and Marstek MARS scanners.

Computer Aided Technology packages its new adapter with the *CAT Image Enhancer* gray-scale conversion software. It supports



The CAT Hand ScanAdapter LPT allows you to connect a scanner to your laptop.

VGA with resolutions of 640 by 480 on a 16-gray-level screen display. Features include aspect ratio control, autoscaling, user-selectable contrast control, and cropping capabilities. *CAT Image Enhancer* supports dot matrix, laser, and ink jet printers. It is compatible with Aldus *PageMaker*, Xerox *Ventura Publisher*, *WordPerfect*, and other programs that support .PCX or TIFF file formats.

List Price: CAT Hand ScanAdapter LPT, \$149. **Requires:** 640 RAM, a supported scanner, DOS 3.1 or later, and a graphics adapter. Computer Aided Technology Inc., 10132 Monroe Dr., Dallas, TX 75229; 214-350-0888.

CIRCLE 448 ON READER SERVICE CARD

NISCA Combines Image Editing with Scanner

NEW Operating under *Windows 3.0*, the NISCAN/GS OCR is an 8-bit hand scanner that scans true gray scale, while offering both image editing and optical character recognition. NISCA has combined the features of the NISCAN/GS with *Image-In* software: *Image-Scan & Paint* and *Image-Plus* graphics software, and *Image-Read* trainable omnifont OCR

software. The entire package retails for \$599.

The NISCAN/GS OCR utilizes *Windows* operations such as cut, copy, and paste. Additional image editing and OCR capabilities are accessible through pull-down menus. A desktop toolbox handles post-scan editing, including paint fills, image shaping, gray-map editing, and image pattern selections. The gray-map editing feature offers a full set of gray-shade modification options ranging from posterization to custom gray-map design. *Image-In's* stitching feature makes the scanner suitable for full-page or larger image scans. The scanner captures 256 shades of gray at resolutions of 25 to 400 dots per inch.

The NISCAN/GS OCR functions as an integral part of many desktop publishing systems and word processing packages, including *Ventura Publisher*, *PageMaker*, *Aml Professional*, *WordPerfect 5.1*, *Microsoft Word*, *Word for Windows*, *Arts & Letters*, *CorelDRAW*, and *ColorIX*. Supported image file formats include .IMG, .TIF, .PCX, and *Windows* Paintbrush formats.

List Price: NISCAN/GS OCR, \$599.

Requires: *Windows 3.0*. NISCA Inc., 1919 Old Denton Rd., #104, Carrollton, TX 75006; 800-245-7226, 214-242-9696.

CIRCLE 450 ON READER SERVICE CARD

TRI/O Integrates Office Equipment

NEW **Elite High Technology's** new TRI/O product line consists of two low-end multifunctional peripheral controller systems (MPCs). The T1000 and the T500 are modular systems designed to integrate everyday office functions such as faxing, printing, and copying.

Rather than designing an all-in-one machine, however, Elite has succeeded in adding functionality to existing office equipment through simple push-button access. Working directly off of PC and LaserJet systems, the TRI/O products provide plain-paper fax receiving, file fax transmission, laser printer acceleration, modem communications, and the integration hardware and software. With a scanner added, the systems are capable of transmitting fax documents and producing copies.

The full-featured TRI/O T1000, retailing at \$2,999, comes complete with CPU, a 40MB hard disk, the TRI/O Control Panel, the TRI/O Jet Print Cartridge printer accelerator, and ports for connecting peripherals. An additional 1MB RAM is required for handling 8.5-by 14-inch documents. Priced at \$899, the TRI/O T500 is an add-in controller board. It performs all of the functions of the T1000 but shares the host PC and hard disk.

List Price: TRI/O T1000, \$2,999; TRI/O T500, \$899, additional 1MB RAM, \$99. Elite High Technology Inc., 3838 Del Amo Blvd., Torrance, CA 90503; 213-370-2762.

CIRCLE 700 ON READER SERVICE CARD

Don't miss the Second Annual International Paradox User's Conference. April 7-10, 1991. Call 1-800-942-8872.

Make Powerful Connections with Borland's New Paradox

By any standard, Paradox® is the most powerful database. That's why it's been rated #1 by every leading computer publication, and why hundreds of thousands of users worldwide have switched to Paradox.



Now there's another reason to switch to Paradox—it **connects**.

Now Ready to Connect with SQL

With Paradox® SQL Link (sold separately),* Paradox makes it easy to connect PCs to the networks and SQL servers of your choice.** No programming is required. Users don't need to learn SQL. And since LAN traffic is kept to a minimum, answers to queries are delivered FAST!

All the power and ease-of-use of Paradox now transparently connect with your SQL data, including: Query By Example, multi-table forms and reports, presentation-quality graphics and much more.

Connects with Programmers

Paradox includes a full development language (PAL™) for building complete database applications. And now, with Paradox SQL Link, programmers can integrate SQL statements into PAL programs, use SQL table cursors, trap server error codes, and tap the unique capabilities of different database servers.

Connects with the Full Power of Your PC

Paradox 3.5 incorporates VROOMM™ and Turbo Drive.™ These proprietary Borland technologies let Paradox

automatically optimize your computer's use of available memory, and access up to 16Mb of RAM on 286/386™/486™ PCs. The result is lightning-fast database performance on any PC.

dBASE Owners!

Step Up for Only \$175⁰⁰

At \$795, Paradox is the best database value around. And to introduce its power and speed to dBASE® users, we're making an outrageous offer: If you own any version of dBASE, we'll sell you Paradox 3.5 for only \$175⁰⁰ (Does not include Paradox SQL Link, sold separately).† Paradox will read and write dBASE files for easy integration into your existing environment.

Upgrade to Paradox 3.5 Now.
See your dealer or call
1-800-331-0877

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B O R L A N D

Makers of Paradox®, Quattro® Pro, Turbo C++, Turbo Pascal® and Sidekick®

CODE: ME39

*Paradox SQL Link (\$495 suggested retail) is an add-on product for Paradox 3.5 and is required to make the connection with SQL servers. **Microsoft, IBM, Oracle and DEC RDB VMS servers supported now. †Offer also good for owners of any version of dBASE or dBase. Proof of ownership (a page from the manual) is required. Satisfaction guaranteed or your money back. Upgrade offer expires March 31, 1991. Upgrade pricing good in U.S. and Canada only. Mail orders to: Borland International, Inc., P.O. Box 1660001, Scotts Valley, CA 95067-0001. Add \$9.00 for shipping and handling. Residents in CA, CT, GA, IL, MA, MI, MN, NY, OH, PA, TX, VA and WA, please add appropriate sales tax. For orders outside the U.S., call (408) 438-5300. 386 and 486 are trademarks of Intel Corporation. Copyright ©1990 Borland. All rights reserved. BI 1395

Improved

BRIEFS



MEMORY MANAGEMENT

Helix Software's memory manager for networked PCs, *Netroom* (single user, \$79.95; four users, \$149; ten users, \$249; 100 users, \$549), has added *Windows 3.0* compatibility. The program can free up to 600K of conventional memory by loading workstation-based applications, TSRs, and network drivers in expanded and extended memory. The new RAM-MAN/386 module optimizes the program for 80386-based PCs. 718-262-8787.

Merrill & Bryan Enterprises now offers Version 6.0 of *Turbo EMS* (\$99.95), which adds the ability to use High DOS while running *Windows 3.0* in enhanced mode. 619-689-8611.

V Communications has released Version 1.81 of its *Memory Commander* (\$129.95). The upgrade provides over 900K of contiguous DOS memory. *Windows* compatibility is forthcoming and will be provided free to registered owners of the program. 800-648-8266, 408-296-4224.

Lerman Associates' memory management add-in for Lotus' *Symphony, Extra K* (\$79.95), has been improved to load more data into extended memory, leaving conventional memory free to run *Symphony* and other add-ins. 508-692-7600.



NEURAL NETWORKS

NeuralWare has made its neural network development system, *NeuralWorks Professional II/Plus* (\$1,895), substantially easier to use. Also new is *FlashCode*, a back propagation interpreter that generates C code for standalone applications. Forty new commands and seven new network types have been added. 412-787-8222.

California Scientific Software's *BrainMaker Professional*, Version 2.0 (\$795) has improved its optimization features, and added new application training, synapse editing, and generalizing tools. Other new features include a reporter, C source code to add neural networks to applications, and EMS/XMS support for up to 8,000 neurons per layer. 916-477-7481.

Enhanced Mapping For Windows 3.0

IMPROVED Hyperdyne's desktop mapping program, *Mapix*, now runs under *Windows 3.0* and has added a number of new features, including an "image-warp" utility for easier and more accurate geocoding. Version 3.10 also adds an image cache, support for more colors and math coprocessors, coordinate grid overlays, and a script language. DDE links to other *Windows* applications are available through its "External Program Interface."



Hyperdyne's Mapix 3.10 uses coordinate grids to help you find your way.

All maps are .PCX files created from scanned raster images and can be exported to *Paintbrush* and most desktop publishing or presentation graphics packages. Data is associated with the map graphic via a comma-delimited ASCII file.

List Price: *Mapix*, Version 3.10, \$1,795.
Requires: *Windows 3.0*. Hyperdyne Inc., 4004 Woodland Rd., Annandale, VA 22003; 703-354-7054.

CIRCLE 435 ON READER SERVICE CARD

View Your Database From Anywhere

IMPROVED *db.Quick*, a new memory-resident viewing utility from **Alpha Software**, allows fast access to database files for its *Alpha Four DBMS*. *db.Quick* also works with any dBASE-format database files, making it suitable for programs like *dBASE III* and *IV*, *FoxBase*, etc. The 188K TSR reduces to 18K when expanded memory or hard disk swapping is used.

db.Quick offers several functions including viewing in both form or table format, browsing, and full search capabilities. Information in a database can be pasted into applications. For example, it can merge an address with a letter in a word processing program, or dial a number in a communications package.
List Price: *db.Quick*, \$99. **Requires:** DOS 2.0 or later. Alpha Software Corp., One North Ave., Burlington, MA 01803; 617-229-2924.

CIRCLE 436 ON READER SERVICE CARD

Automatic Emulation Sensing from QMS

IMPROVED The emulation switching feature that debuted in QMS's PS-410 laser printer is now available in its full laser printer line. The resident software, called *ESP (Emulation Sensing Processor)*, automatically swaps between PostScript, HP-PCL, or HP-GL printer languages as needed without input from the user.

The printers that now include *ESP* are: QMS-PS 810 and 820, QMS-PS 810 and 820 turbo, and QMS-PS 2210 and 2220. Current owners of QMS laser printers may add *ESP* for \$149.

List Price: \$149 for upgrade. **Requires:** QMS laser printer. QMS Inc., One Magnum Pass, P.O. Box 81250, Mobile, AL 36689-1250; 205-633-4300.

CIRCLE 437 ON READER SERVICE CARD

Multitasking Without Mega-Bucks

IMPROVED **SoftLogic's** *Software Carousel*, which won the Editors' Choice award in our roundup of low-cost task switchers ("Task Switchers: The Hot Key to Fast Application Access," October 30, 1990) has added a number of improvements in Version 5.0, including "Snip 'n' Snap," a data link between applications.

Other new features include access to source code for C programmers to interface with other applications, a message center, easier installation, context-sensitive help, pull-down menus, an alarm clock, and a stopwatch.
List Price: *Software Carousel*, Version 5.0, \$89.95. **Requires:** 256K (640K recommended), DOS 2.0 or later. SoftLogic Solutions, One Perimeter Rd., Manchester, NH 03103; 800-272-9900, 603-627-9900.

CIRCLE 438 ON READER SERVICE CARD

Low-Cost DBMS Adds Browsing, Indexing

IMPROVED **Timeworks** has added a host of new features to its low-end database, *Data Manager PC*. Version 3.0 includes relational features, graphics capabilities, a macro processor, and automatic indexing. A new browse mode allows viewing of up to 19 records simultaneously in table mode.

Some nice new touches include a memo pad that holds up to three pages of text and a built-in calculator, as well as an automatic timed back-up feature.

List Price: *Data Manager PC*, Version 3.0, \$59.95. **Requires:** 512K, DOS 2.1 or later. Timeworks, 444 Lake Cook Rd., Deerfield, IL 60015; 708-948-9200.

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Get the Z-486/25E™ Personal Workstation—now pre-installed with the personal productivity tools you really need.

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But the Z-486/25E is more than just powerful. It has all the convenience and flexibility of a PC. And now that it's pre-installed with Microsoft® Windows™ version 3.0—and comes standard with a Microsoft Mouse—the Z-486/25E adds up to *The Seamless Solution*™ for your computing world.

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Medallion Reseller,
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Graphics simulate Microsoft Windows version 3.0, a product and trademark of Microsoft Corporation. i486 is a trademark of Intel Corporation. TIGA/VGA is a trademark of Texas Instruments Corporation.

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CIRCLE 732 ON READER SERVICE CARD

Never



Peter Norton

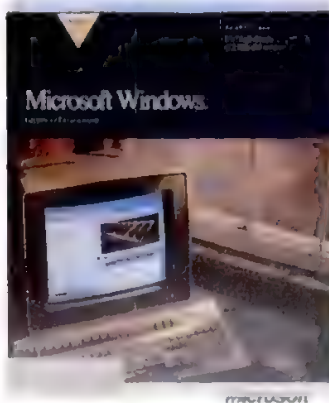
When it comes to your crucial data, Peter Norton just won't take **C>FILE NOT FOUND** for an answer. With programs like the Mace Utilities* and PC Tools*, data recovery is often mission impossible. But with the Norton Utilities* 5.0, data recovery is mission *critical*—and it can recover what no other utility can.

Data Recovery is serious business, which requires serious features. And the Norton Utilities has them all.

Norton Does Windows.

The Norton Utilities is *the* safe DOS utility program for use with windowing environments like Windows* 3.0 and DesqView.

Because PC Tools and Mace Utilities are blind to multi-tasking, they can irreversibly damage your files. While the Norton Utilities 5.0 offers three full levels of safety checks under Windows 3.0.



With a clear vision of the PC's future, the Norton Utilities 5.0 provides safe Windows 3.0 recovery.

Norton On Networks.

The Norton Utilities is the *only* utility program that provides file recovery on Novell and DOS-compatible networks. So you can use *File Save* along with *UnErase** to recover deleted files*, or *File Fix** to reconstruct Lotus* 1-2-3* and dBASE* files. From any node on the network.

What's more, MIS will appreciate the Norton Utilities' compliance with existing network security restrictions.

System Information provides detailed reports on network information and TSR memory allocation, as well as graphical benchmarks of disk, CPU, network, and general computer performance.

The next best thing to being there is being on the network. And the Norton Utilities 5.0 is the only data recovery tool that is.



DATA RECOVERY FEATURES	NORTON UTILITIES	PC TOOLS	MACE 1990
Number of DOS Error Messages With On-Line Advice	75	0	0
Different Types Of Data Loss Problems Solved			
File System Corruption	31	12	15
Physical Hard Disk Damage	6	0	0
Internal Data File Damage (i.e. dBASE, Lotus)	10	0	6
Disk Reliability Testing (Number Of Patterns)	80	0	0
System Information (Topics Reported)	94	15	16
NETWORK file recovery *File Save must have been installed prior to data loss.	YES*	NO	NO
WINDOWS Safe Operation	YES	NO	NO
Failsafe Design	YES	NO	NO
Effective File Encryption That Does Not Require You To Change The Way You Work	YES	NO	NO

Say Die.

Rated #1
Hard Disk Utility
InfoWorld 12/10/90

Norton's Superior Recovery Technology.

The Norton Utilities handles the toughest data recovery situations easily—predicaments other utilities handle poorly, if at all.

Advise explains cryptic DOS error messages in plain English so you can understand the problem, and gives specific recommendations on how to fix it. So your valuable data is not at the mercy of risky trial-and-error procedures.

Unlike the competition, Norton recovery procedures are easy to use and completely failsafe. And because you can UNDO changes, you won't make a bad situation worse. In fact, while using the Norton Utilities your data will even survive a sudden power loss. All in all, it's the safest, most extensive diagnostic and recovery utility available.

And only the Norton Utilities gives you every-

Norton Utilities 5.0 Adds Features, Improves Interface

"Norton's disk utilities now surpass anything you can find in PC Tools Deluxe or The Mace Utilities, and offer safeguards you can't find anywhere else."
—PC Magazine 10/16/90

Don't just take our word for it, the proof is in the press.

thing you need for optimal system performance.

The new *Norton*

Cache and the improved *Speed Disk*™ make your hard drive faster and more efficient. And *Calibrate*™, which outperforms *SpinRite*™, adjusts the interleave, identifies bad sectors, and even repairs demagnetized

areas of your drive.

So get serious about data recovery. See your dealer for the new Norton Utilities 5.0. To upgrade now call **1-800-343-4714** or fill out the coupon below. For more information, call **1-800-343-4714 Ext. 708** (in Canada, 1-800-465-2266). And in the immortal words of Peter Norton, "Never say die."

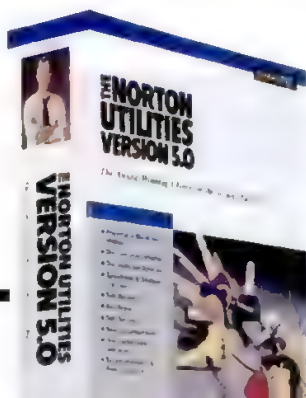
SYMANTEC.

\$59

Upgrade Now and Save \$120!

Mace Utilities and PC Tools users can now get the Norton Utilities 5.0—list price **\$179**—for **\$59**. Just send this coupon to Symantec, along with the title page from your Mace Utilities or PC Tools product manual. Send a check or have us bill your VISA or MasterCard **\$59** plus tax and \$5 shipping and handling.

Norton Utilities 5.0 offer expires April 30, 1991. Valid in U.S. and Canada only. Please allow 4-6 weeks for delivery. Only one upgrade per coupon. For multiple upgrades or POs, call 1-800-441-7234. For Canadian orders, call 1-800-465-2266.



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Address _____
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City/State/Zip _____
☐ Check enclosed ☐ VISA ☐ MasterCard
All payments must be made in US dollars drawn on a US bank.
Name as it appears on your card (please print) _____
Acct. No. _____
Exp. Date ____/____/____ Day phone (____) _____

Quantity	Disk Size	Unit Cost
One	☐ 5 1/4-inch ☐ 3 1/2-inch	\$59.00
In these states, add sales tax including applicable local tax: CO 3%; GA, IA, MI, NY 4%; MO 4.225%; IN, MD, MA, OH, WI 5%; DC, FL, MN, PA, CA 6%; IL, TX 6.25%; WA 6.5%; NJ 7%; CT 8%.		
Add shipping and handling:		\$ 5.00
Total:		_____

Send to: **Symantec Corporation**
Attn. "Never Say Die" Offer • P.O. Box 161690
Cupertino, CA 95016-1690 PC, 3/26/91

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NO WAY!

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We Added...

to DesignCAD 2D version 4.2: A Basic-like programming language entitled BasicCAD. We added multiple work windows. We added user definable screen and digitizer icon menus. We added dozens of rubberband features. We added more than 40 new commands and made hundreds of enhancements.

How much extra did we charge?

Nada. Nothing. Zip. No extra charge at all. Oh, sure...our accountant said we could increase the price. Our lawyer said there was no legal reason not to charge more. A minister said we had no moral obligation to keep the same price! So, why didn't we raise the price for DesignCAD 2D version 4.2? Because...in the Great American Tradition we said "Aw...What the Heck. Let's see the other guys beat this price!" DesignCAD 2D version 4.2 sells for \$299.

Does this include everything?

Yes. We include everything! The programming language, the ability to add your own icon menus, over 500 predrawn symbols, translators to-and-from other file formats, all hardware drivers are all included!

How can you afford to sell a program like this at such a low price?

This is our most often asked question. We have a simple answer. Volume. We sell thousands of these programs each month! If we were to charge thousands of dollars per copy (like our competitors) we would restrict our sales to the professional trades only. By lowering our price we sell to professional architects and engineers as well as the ordinary individual!

Many ordinary individuals purchase DesignCAD 2D for personal projects. Many people purchase DesignCAD 2D and perform CAD Drafting at nights and on weekends as a second job! People design "dream homes" and "widgets". The uses are limited only by YOUR imagination!

Remember - American Small Business Computers also sells a 3D version of DesignCAD. It costs only \$399! Write or call for FREE brochures that will help you determine which program best suits your needs.

If there ever was a CAD program out to prove that AutoCAD, CADKEY, VersaCAD, and other \$3000 programs are overpriced, it's DesignCAD!

(MicroCAD News review)

DesignCAD 2D



\$299

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CIRCLE 475 ON READER SERVICE CARD

edited by
Matthew J. Ross

Read Only

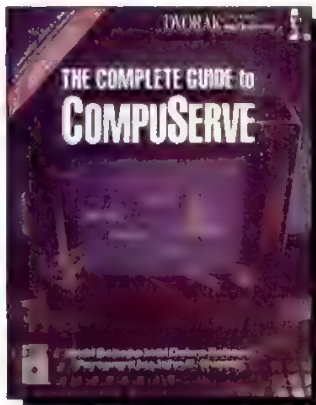
Reviews of the Latest Books for the PC User

CompuServe's New Look

In late 1989, CompuServe, the industry leader in on-line services, introduced the *CompuServe Information Manager (CIM)*, a \$24.95 graphics communications program. Its pull-down and overlapping menus provide a mousable interface that makes the service easier for new users and more attractive for experienced on-liners. *CIM* has inspired two new books to help you navigate CompuServe's labyrinth.

■ *The Complete Guide to CompuServe*
by Brad and Debra Schepp
Osborne McGraw-Hill, \$34.95
Brad and Debra Schepp's breezily written and well-organized overview helps users judge the cost effectiveness of CompuServe's features. *The Complete Guide to CompuServe* also includes an expert appendix by Alfred Glossbrenner describing efficient ways to search for on-line software. A bound-in disk contains a demo version of *TAPCIS (The Access Program for the CompuServe Information Service)*, regarded by many CompuServe regulars as the program of choice for accessing forums and electronic mail.

Much of the book explores CompuServe using *CIM* menu options, but it doesn't ignore other programs that access the system faster. An invaluable chapter treats specialized navigational programs and describes how to write scripts for general-purpose comm software. The book recommends *CIM* as a good beginner's program but encourages experienced users to try other strategies to



The Complete Guide offers useful tips to increase your on-line productivity.

minimize on-line charges.

Occasional inaccuracies mar the text, such as the statement saying that the Kermit protocol works faster than Ymodem; descriptions of CompuServe's advantages are overenthusiastic, but for the most part, the book provides a browsable and good-humored overview of the service. The authors make some tough criticisms of less-useful features while drawing attention to CompuServe's best values. For the demo programs and \$12.50 access time coupon alone, their entertaining book offers a good value.

Osborne McGraw-Hill, Berkeley, CA 94710; 800-227-0900, 415-548-2805. ISBN: 0-07-881632-7.

CIRCLE 396 ON READER SERVICE CARD

■ *CompuServe Information Manager: The Complete Sourcebook*
by Charles Bowen and David Peyton
Bantam Books, \$22.95



Charles Bowen and David Peyton bring an insider's perspective to their book, *CompuServe*

Information Manager: The Complete Sourcebook. The two have written regular editions of the popular guide *How to Get the Most Out of CompuServe* for the last six years and compose a column for the service's on-line newspaper.

CIM's own documentation already does a pretty good job, but the new book provides some good detail on *CIM*'s extra functionality. The authors also give a preview of *CIM*, Version 2.0, although they don't report, as the Schepps do, that the only change to the new version is that it will operate at a faster pace. Their book is also not as up-front: It doesn't really warn you about the bugs users have found, nor does it tell about *CIM*'s slow speed on all but the fastest machines.

The cost of the Bowen and Peyton book is nearly as much as the *CIM* software itself, but a \$12.50 usage credit for CompuServe helps compensate. And the book's in-the-know discussions of CompuServe history and its handy appendix listing of forum message sections, libraries, and activities make it an interesting reference for CompuServe buffs to keep nearby.

Bantam Books, New York, NY 10103; 800-223-5780, 212-765-6500. ISBN: 0-553-34998-8.

CIRCLE 397 ON READER SERVICE CARD

■ *Inside CompuServe*
by Julie Anne Arca and Richard T. Lindstrom
New Riders Publishing, \$29.95
Inside CompuServe: The Easy Start Guide to Online Information and Communications devotes only a few pages to *CIM*, yet it aims more squarely at the

beginner's market than the other two volumes. Julie Anne Arca and Richard T. Lindstrom present the service primarily through the terminal emulation mode of *TAPCIS*, which is included along with its freeware rival, *AutoSIG*, on two bound-in disks. The disks also contain shareware file-compression utilities, PKware's *PKZIP* and *PKUNZIP*, and California Software Design's *SHEZ*. This in itself will save you an hour of downloading time.

This book provides the best introduction for the CompuServe newcomer who is not using *CIM*. It explains how to prepare for the trip by setting up and testing the modem and communications



software. It then takes you on a tour through CompuServe's least expensive areas. The book also caters to the

impatient traveler, with quick-start sections for those who are bold enough to strike out on their own.

Inside CompuServe even provides a little something for the more experienced user, with clear, detailed information on selecting the correct modem parameter set, initialization string, and error-checking protocol, and how to troubleshoot the setup. Well organized overall, the text sometimes can get a bit repetitious, but mainly to ensure that browsers don't overlook any information that might be essential.

—Michael Cohn
New Riders Publishing, Thousand Oaks, CA 91360; 800-541-6789, 818-991-5392.
ISBN: 0-934035-83-0

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WE BRING THE HIGH COST OF NEW-TECH DOWN FAST.

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by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Software Publishing Sells PFS Line as Part of Strategy To Relaunch Itself

The news that Software Publishing sold the PFS software line will bring back a flood of memories to longtime PC users.

PFS:Write and *PFS:File*—once the cutting edge of micro-computer software design—now seem like old friends from a simpler time.

Since its 1983 debut on the PC, the series did more than help make Software Publishing a \$100 million company; it helped launch the PC itself.

Spinnaker Software of Cambridge, Massachusetts, is hoping that, in 1991, the PFS series still has some magic left.

Spinnaker is taking over the marketing of the PFS products now on the market: *PFS:First Publisher*, *PFS:First Choice*, and *PFS:First Graphics*. The company plans to launch a series of Windows-based applications under the PFS brand name within a few months.

Spinnaker is in the process of trying to transform itself from a company known mainly for educational software into a broad-based publisher of productivity software. Its introduction of *Plus*, the HyperCard-compatible Windows application generator, has been its most notable product to date.

Repositioning and enhanced marketing can make a big difference in the software business. Note that in this week's Top 15 list (following page), *Eight-in-One*, the company's easy-to-learn integrated package, is at number 14—the first time Spinnaker has ever had a program that's shipped enough copies to rank among the best-sellers.

As Spinnaker attempts to grab a share of the low-end market, Software Publishing is hoping that this move will help free the company from the burden of supporting and developing products that now run counter to the company's long-range strategy.

InfoAlliance, a client-server graphical database designed for enterprise-wide forms management, is more typical of the direction Software Publishing plans to take.

And when Software Publishing introduces its first Windows product later this year, the word processor will be powerful and, while it won't be quite as ambitious as *InfoAlliance*, it's a couple of generations beyond the level of features that the PFS line achieved.

Software Publishing isn't completely forsaking the market that it knew so well. The terms of the sale include the transfer of 16 percent of Spinnaker's common stock to Software Publishing and royalties on future sales of the programs.

WordStar Tries to Buy Its Way Into the Windows Market
Another pioneer from the early days of the PC—*WordStar*—has had an even more difficult time finding a place in today's PC marketplace.

In a corporate move that may ultimately sound the death knell for the word processing program's controversial interface, WordStar International has acquired rights to market *Legacy*, a Windows-based combination desktop publishing-word processing program.

The company will soon begin distributing the program under the name *WordStar Legacy*. The financial terms of the deal were not disclosed.

WordStar is expected to gradually blend the two programs into one: A strategy that is unlikely to win back the legions of faithful *WordStar* users, many of whom still use versions that were released in the mid-1980s and have been heavily customized.

It's widely believed that *Legacy* was WordStar's second choice. Before Lotus made its bid, WordStar attempted to negotiate a deal with Samna for *Amf Pro*.

Spinnaker plans to launch a series of Windows-based applications under the PFS brand name within a few months.

Management Shakeup May Change Compaq's Policies
Compaq seems to be reevaluating its highly successful marketing-distribution strategy.

In January, its longtime marketing chief, Mike Swavely, suddenly announced he was leaving for an indefinite leave of absence.

He was replaced by Eckhard Pfeiffer, who had been running overseas operations for the Houston-based company.

The choice reflects the increased importance of international sales to American computer makers. Compaq now earns more than half of its money outside the U.S.

Look for changes in Compaq's distribution policies.

DVI: Coming Soon to a Tavern Near You

Intel's DVI (digital video interactive)—a technology that has the potential to turn the PC into a full-motion video powerhouse—may turn out to be the next fad in bar room-based entertainment software.

Data East USA is planning to introduce video arcade games using DVI. The company will use Intel's 750 video processor to produce "graphically sophisticated coin-operated video games with animated imagery that approaches film quality." The games will include a CD-ROM player and proprietary circuitry.

The first of the games are expected to be in arcades later this year.

Meanwhile, Intel is still working with PC manufacturers who are testing a two-chip version of the technology that was released in late 1990.

Ashton-Tate Fighting in the Courts to Protect dBASE
Is *dBASE* in the public domain?

Back in December, a U.S. District Court judge said it was but Ashton-Tate has scored a small victory in its effort to have that ruling overturned.

The federal judge found Ashton-Tate's initial copyrights on the *dBASE* language invalid because the company failed to

CONTINUES ON PAGE 69

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Pipeline

CONTINUED FROM PAGE 67

divulge the connection between *dBASE* and its predecessor—a public domain database manager that Wayne Ratliff worked on at the Jet Propulsion Lab—when the initial copyright application was made.

Ashton-Tate brought the case to the courts in 1988 to claim that Fox Software infringed on Ashton-Tate's copyrights by selling a *dBASE*-compatible compiler. The judge ruled in favor of Fox and shocked Ashton-Tate by saying it "knowingly and with an intent to deceive" hid *dBASE*'s true origins in the initial copyright filing.

In January, Ashton-Tate successfully petitioned for the right to file an early appeal, a situation that prevents the December ruling from becoming final until the appeal is heard.

With 10th Anniversary Approaching IBM Tries to Recapture the Early Magic

An independent personal computer team in Boca Raton, Florida, paid off well for IBM once and now, nearly ten years after the August 1981 introduction of the IBM Personal Computer, a new R&D lab is being opened in Boca Raton in order to design and introduce PC products more quickly.

IBM said the lab will "blur the lines between software and hardware" in order to build teamwork.

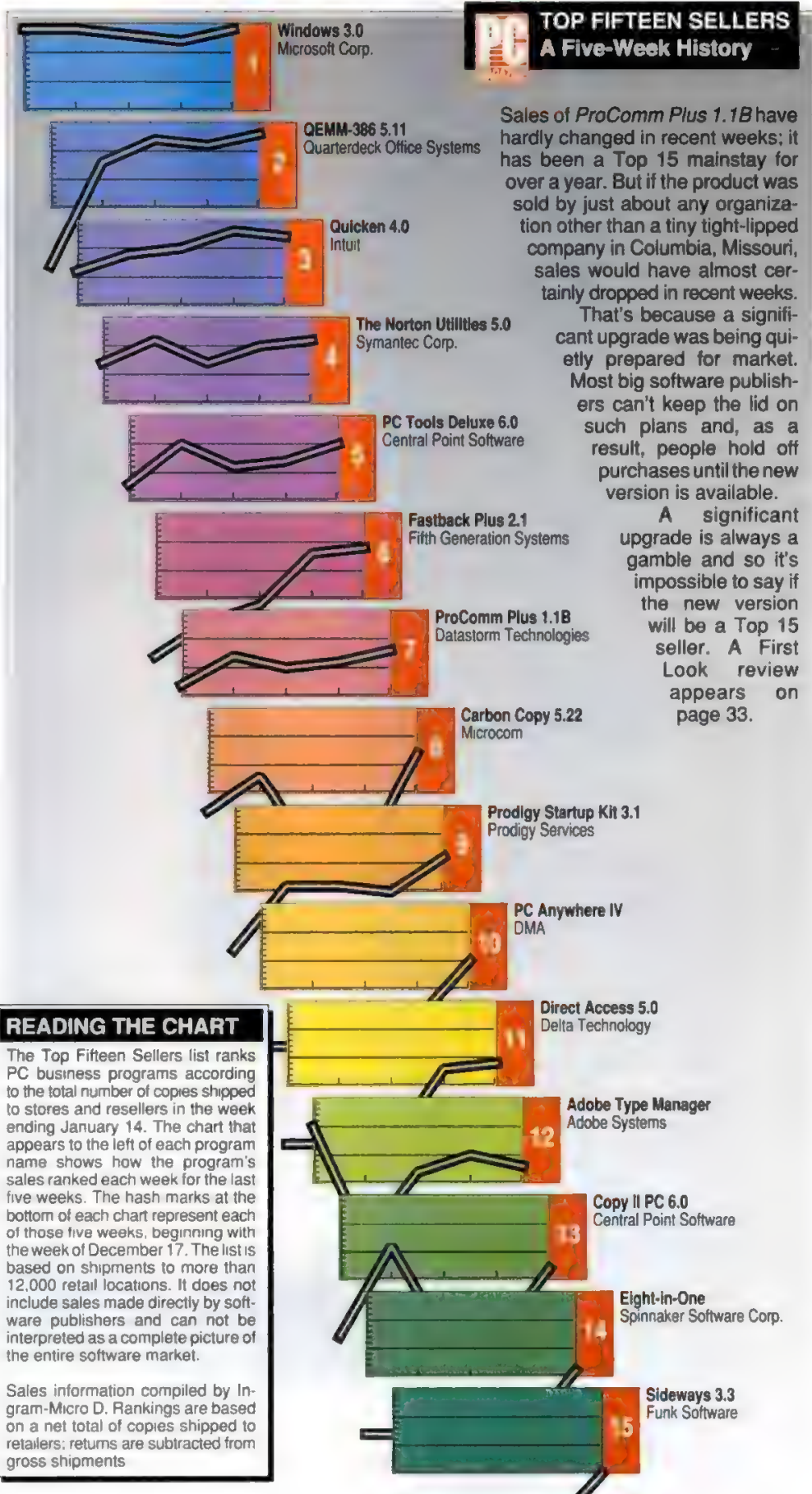
The team of 1,600 employees had been spread out over 42 different buildings.

The group's first projects are a much-delayed new laptop, and a new version of OS/2.

Hayes Wins Patent Suit

A U.S. District Court jury found that a Hayes Microcomputer Products patent covering timing specifications in the AT command set is valid and that Everex Systems, Ven-Tel, and OmniTel have been infringing on the Hayes patent.

Seventeen modem manufacturers are already paying royalties to Hayes for the right to use the technology.



READING THE CHART

The Top Fifteen Sellers list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending January 14. The chart that appears to the left of each program name shows how the program's sales ranked each week for the last five weeks. The hash marks at the bottom of each chart represent each of those five weeks, beginning with the week of December 17. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and can not be interpreted as a complete picture of the entire software market.

Sales information compiled by Ingram-Micro D. Rankings are based on a net total of copies shipped to retailers; returns are subtracted from gross shipments.

Sales of *ProComm Plus 1.1B* have hardly changed in recent weeks; it has been a Top 15 mainstay for over a year. But if the product was sold by just about any organization other than a tiny tight-lipped company in Columbia, Missouri, sales would have almost certainly dropped in recent weeks.

That's because a significant upgrade was being quietly prepared for market. Most big software publishers can't keep the lid on such plans and, as a result, people hold off purchases until the new version is available.

A significant upgrade is always a gamble and so it's impossible to say if the new version will be a Top 15 seller. A First Look review appears on page 33.

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8 expansion slots

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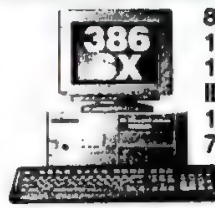
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40MB 28ms	\$819	\$1049
71MB 28ms	\$939	\$1179
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124MB 19ms	\$1059	\$1289

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IDE HD controller
101 keyboard
7 expansion slots

\$629

1-year limited
warranty

12" Amber 14" VGA Color
720x350 .41 dp 640x480

40MB 28ms	\$989	\$1219
71MB 28ms	\$1119	\$1349
89MB 19ms	\$1139	\$1369
124MB 19ms	\$1229	\$1459

Video Card Included! Fully Tested!

COMPUDYNE 386-25C



80386, 25MHz
1 MB, 32K cache
1.2 MB 5¼" Drive
IDE HD controller
101 keyboard
7 expansion slots

\$1099

1-year limited
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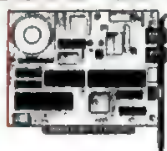
12" VGA White 14" VGA Color
640x480 .41 dp 640x480

40MB 28ms	\$1539	\$1699
89MB 19ms	\$1689	\$1849
124MB 19ms	\$1779	\$1939
211MB 19ms	\$2109	\$2269

Video Card Included! Fully Tested!

Modems

COMPUDYNE 2400i



2400 baud
Internal modem
Viscom software
\$59

ATI 2400 Int. w/MNP5 \$166
Compudyne ext. 2400 \$69
Complete Fax 4800 \$139

Mice



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LTI 1230A VGA mono \$105
NEC Multisync 3D VGA \$629

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ATI VGAWonder 256 Plus \$179
Sigma VGALegend \$239
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Storage Devices



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IDE
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Seagate ST1102A 89MB IDE \$369
Seagate ST1144A 124MB IDE \$469
Seagate ST1239A 211MB IDE \$749
Seagate ST2383A
330MB IDE \$1279
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Kyocera KC40GA 40MB IDE .. \$205
Kyocera KC80G 80MB IDE \$355
Plus Development 40MB
Hard Card II \$345

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Dell System® 318LT	1st	1st	2nd	1st	1st	1st	1st	1st	1st	1st	1st	1st	1st
Toshiba T3100SX	2nd	2nd	1st	2nd	2nd	2nd	3rd	2nd	2nd	2nd	2nd	2nd	2nd
Zenith SuperPort SX Model 40	3rd	3rd	3rd	3rd	3rd	3rd	2nd	3rd	3rd	3rd	3rd	3rd	3rd



It wasn't very pretty.

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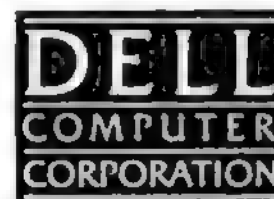
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CIRCLE 332 ON READER SERVICE CARD

Bill Machrone



Back to BASICS

The PC is still a long way from being an information appliance, as programming remains central to wringing out maximum performance.

It had been five years since I wrote my last program. I wrote one last night, and I must say that it felt good. It wasn't a biggie, but it got the job done when there was no other decent way to do it.

The stimulus was my fourth-grade daughter's homework. Not doing it, but checking it. On her worksheet, she had to determine the "cost" of a bunch of songs by looking up the value of each letter of the song title in a table at the top of the page. Then she had to determine what the best mix was in order to buy as many as possible without going over \$15. Of course, the letter values couldn't be as easy as A = \$.01,

B = \$.02, etc. The values were jumbled, the song titles were long, and there were lots of them. I'm terrible at that kind of lookup-and-transcribe operation. It would take me longer to check my daughter's homework than for her to do it.

It was clear from the outset that a brute force table lookup would be the easiest way to solve the problem. I could type in each title, cast out blanks and punctuation, and add up the values for each song. Now then, what language? I've always enjoyed writing table lookups in assembler; the looping and indexing constructs are simple and powerful. Conditional string parsing would have been fun, too, but I/O is still next to nonexistent, and the number of lines of code I'd have to produce was just too high. I quickly dismissed C, since I was rusty enough to be my own worst enemy. I never learned enough Pascal even to be dangerous. My other languages of one-time proficiency, COBOL and PL/I, were out of the question.

So the only real choice was BASIC. The syntax is simple, the interactive debugging would be a big timesaver, and it was already on my machine, courtesy of Microsoft. Twenty lines of code later, Stephanie had a fun way to check her own work. She didn't know a DATA statement from a hole in the ground, but it did the job for her, and I avoided an exercise that I find painful and unrewarding.

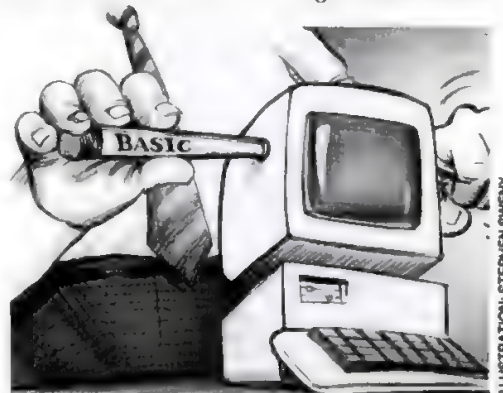
I thought fleetingly of using a commercial application, such as a spreadsheet or a database, but my BASIC program was a model of clarity compared to a Lotus macro that does the

same thing. Sometimes a program is the best way to do things, period.

Back in my user-support days, customers always had a file in one format that they needed in another. It felt like I spent my whole life writing use-once file-conversion programs. As often as not, the files came from an EBCDIC system and needed to be translated to ASCII. It kept my coding skills in shape and added a little drama to my life.

Maybe if you've always stuck to the latest versions of mainstream applications, you'll never have the need for a conversion program. Maybe you don't mind if your screen clears to ugly white-on-black. Maybe you think that the molasses-like repeat rate on your keyboard is just dandy. Or that you'll never need a pop-up calculator. Perhaps you can live without a file finder or a browser that works in *Windows*. But I can't. There's a hundred little things we can do to customize and optimize our PCs. That's one of the reasons why we publish a new utility program in every issue of *PC Magazine*.

The other reason is that the utilities are a good way to keep your coding skills in shape. Or to develop them if you've never had any. The utilities here in *PC Magazine* are more



than handy mini-programs. They're highly accessible examples of programming in assembler, C, and Pascal. You can download not only a working copy of the program from PC MagNet, but the source code, too. There's virtually no program or function that our intrepid programmers haven't tackled. Communications, disk utilities, calculators, keyboards, TSRs, drivers, graphics: from the mundane to the esoteric, we've run it all. Of course, the

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CIRCLE 727 ON READER SERVICE CARD

Bill Machrone

utilities are rather carefully crafted to be useful while not intruding on commercial turf. There's always a better product out there; one that's more complete, faster, or easier to use. You should get the one that works best for you. But if you want to know how it works inside, no commercial software vendor is going to give you source code.

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want. With the source code, you can modify it to your needs. Without it, all you can do is badger the manufacturer. Of course, some utilities are just too complex for magazine publishing. We'll never offer anything on the scale of *The Norton Utilities* or *Magellan*. But you can download some neat file finders, background disk formatters, system information and configuration utilities, and literally hundreds more from PC MagNet. And you can tailor them to your needs, or combine two or more into a custom product for you or your users. You can even include our source code in commercial products, after paying a very reasonable royalty.

What's more, you can talk to the people who wrote the programs. They're regulars on PC MagNet's Programming forum, and you can participate in what amounts to a master class in program design, economical coding, and technique. Even if the author of a utility doesn't answer your question, anywhere from one to a dozen helpful readers will jump in. Volunteerism is alive and well: People are forever solving problems for fellow readers.

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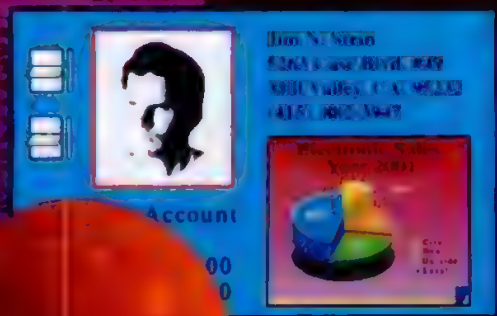
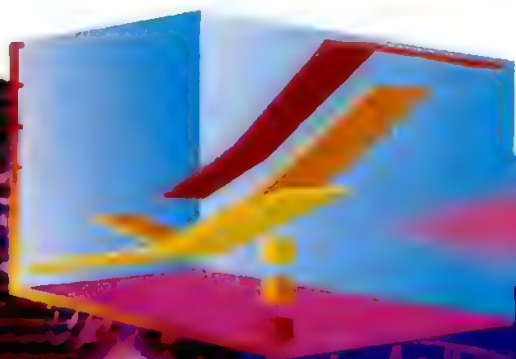
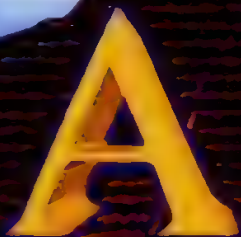


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Twists and Trends

A quick peek at the 1990 Fall Comdex catalog predicts good news for 1991.

Every year I like to index the *Fall Comdex Program & Exhibits Guide* and see what industry trends can be spotted by carefully examining its contents. The 1990 show was significant if for no other reason than the catalog finally broke the 1983 record for size. At 654 pages, it easily surpassed last year's 606 pages and beat the 616-page record established in 1983—the record year that preceded a two year downturn in the business. Hopefully history won't repeat itself.

The Fall 1990 catalog had a first ever hologram on its cover, celebrating the Everex Stepcube machine. Inside, a few new categories revealed some developing trends. The new categories in the Product Locator Index included: batteries (11 exhibitors), Applications: diagnostic (9), on-line services (8), and LAN boards (with a tremendous 77 exhibitors). There weren't a lot of new categories, for sure, but an indication of a couple of networking trends at least. On the other hand, the text management software category was removed from the list. It was the only casualty.

Because the show was so big, almost all the categories had more exhibitors than ever. Clones were a big theme for the last couple of years, but even more so on the component level this year. For example, the makers of cabinets/enclosures increased from 30 exhibitors in 1989 to 47 in 1990. Cable makers increased from 39 to 50.

I was surprised to see bar code-related equipment jump from 15 to 28 exhibitors, which to me indicates that vertical applications are increasing in the market. This was reinforced by the increase in the number of POS (point-of-sale) exhibitors—34 vendors, up from 22 last year. On the other end of the growth curve was facsimile machines, which took off with 42 exhibitors in 1989. This year the category only increased by one. Fault tolerance was a loser, falling from a meager five to an even more meager two exhibitors.

TREND ALERT

One of the hottest trends is image processing. The vendor count, which appeared to be nil in

1983, shot to 40 in 1989, and skyrocketed to 72 in 1990. When I see this, the trend-alert horn sounds in my office.

The category of office automation was new in 1989 and provided 20 new listings. In 1990, it more than doubled, and the 45 exhibitors indicate an increasing interest in this area. When the office becomes important, so does security. This was reflected in the number of people who made safes and other "security products." The exhibitor count went from six in 1989 to 18 in 1990.

Board makers showed more growth from 1989 to 1990. Again the most numerous were the mother/daughterboard makers. In 1989 there were a whopping 94 exhibitors. In 1990 this increased to a near ludicrous 145 vendors! The exhibitors classified as "Computers: board level" increased from 74 to 122! This show has obviously changed over the years into a component show. In 1983 there were only 30 such exhibitors.

Another hot trend is the hand-held computer. In 1989 this was a new category and eight vendors exhibited. This has already shot to 35 in one year. Worse, the laptop makers exhibiting shot from a bloated 54 in 1989 to a



ILLUSTRATION: STEPHEN SWENY

stunning 131 in 1990. If there was ever a blood bath waiting to happen, look for it in laptops.

Vendors who felt they should be categorized as "workstations" increased from 50 to 110, indicating a shift in self-appraisal or semantics. Nearly every other category simply grew incrementally. It was a hot year for growth in all categories as they reflected the market at-large. I couldn't find anything going downhill, and that trend should carry over effortlessly through most of 1991.

Printer Sharing Solutions

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- **Easy to Install and Use**
- **No PC RAM Memory Required**
- **Toll-Free Technical Support**
- **45-Day Money-Back Guarantee**



HWP 5 Ports

HWP-256	with 256KB	\$325
HWP-512	with 512KB	\$375
HWP-1000	with 1MB	\$425

User Upgradable Memory:
From 256KB to 16MB buffer

Input/Output Settings – 4/1 or 3/2:
All parallel ports; user configurable as either three inputs to two outputs, or four inputs to one output, buffered auto-switch

Rapid Data Transfer – 100,000 cps:
The HWP uses Direct Memory Access (DMA) for data transfers into the buffer, making the HWP hardware capable of receiving parallel data at the high rate of 100,000 characters per second.

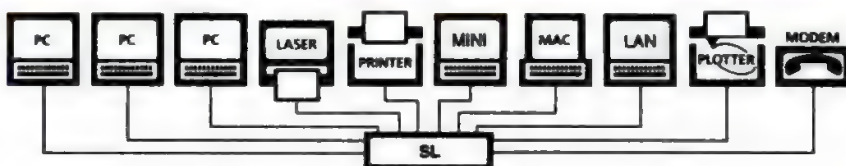
Pop-up Menu or Front Panel Buttons:
Use either the pop-up menu or the front panel switches to select printers, select the next available printer, send multiple copies, clear data, and other functions.

AS-41 5 Ports \$200

Smart Switch – No Pop-up or Buffer:
Four parallel inputs to one parallel output, electronic automatic switch with no buffer

SPPS (not shown) \$100

Interface Converter – No Buffer
Combination serial-to-parallel, or parallel-to-serial interface converter in a single unit; low-power CMOS design derives power from serial connection, no power supply needed; supports 9,600 to 115,200 bps, DIP switch configurable



Save Money by Sharing Office Resources:

The SL is the peripheral sharing solution which enables everyone to share lasers, printers, plotters, and modems. The HWP is ideally suited for sending large graphics files, but is economical enough for any kind of printing within a small workgroup.

Greater access by more users reduces unproductive idle time and the expense of purchasing additional peripherals. With a buffer, all users can simultaneously send print data and quickly release their PCs to continue working.

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Fax (503) 585-4505

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SL or SLP 10 Ports

SL or SLP-256	with 256KB	\$495
SL or SLP-512	with 512KB	\$575
SL or SLP-1000	with 1MB	\$675

Two Configurations – Ten Ports Each:
SL – four parallel and six serial ports
SLP – eight parallel and two serial ports
Both include 15 ft. serial null-modem cable

User Upgradable Memory:
From 256KB to 4MB buffer

Any Combination of Printers or PCs:
All ten SL or SLP ports can be software configured as either input or output.

Automatically Routes and Buffers Data:
Automatic switching and queuing of jobs; automatically converts data from parallel-to-serial or serial-to-parallel

115,200 bps PC-to-PC File Transfers:
Transfer files serially between PCs up to 115,200 bps; buffer serial data to the SL several times faster than normal 9,600 bps

Pop-up Menu via Hotkeys or Mouse:
Keyboard selection of printers and many other control functions; pop-up is for convenience, but is not required

Simple Installation:
Plug in your cables; if desired, run the installation software for the pop-up menu
CIRCLE 328 ON READER SERVICE CARD

Inside Track

Nobody knows what to think now that word is **leaking** out that IBM will be making its own **486 chip**. Not wanting to deal with Intel and its backlog of high-end microprocessor orders, IBM will take advantage of its old deal with Intel to make the chip itself. Further integration of components will help IBM extend the **profit margin** on those pricey desktop machines. IBM looks more and more like the "smart cookie" among the computer makers despite **falling** market share. I'm told the chip will be manufactured at the **Manassas, Virginia**, fabrication facility. The local dump might be a good place to look for reject parts.

Let's just Skip the Middleman Dept.: While many users are waiting for 400-dot-per-inch scanners and laser printers, it's obvious that **400 dpi anything will never achieve much market success**. Fine-tuned laser engines easily achieve 800 dpi, and now I see the new Panasonic FX-RS307U Image Scanner has been announced as a 600-dpi scanner incorporating 256-shade gray scale and an 18-second-per-page scan time for fine scan. Many scanner makers are jumping to this resolution. You can **kiss 400 goodbye**. It was stillborn.

Buy This Book Dept.: Many of you inside and around the computer industry go to one or more of the trade shows that facilitate your lives. Sometimes you see on the TV news coverage of a trade show that you wish you'd attended. Sometimes you schedule something to discover that you'll miss a trade show that you hoped to attend. You need a copy of **1991 Trade Shows and Exhibits Schedule**. It lists all the major trades shows around the world. They are listed by date, by category, and by location. I now know, for example, that on April 7, the **Plastics Fair** will be in Boston. This 400-page catalog of trade shows is a must for anyone in business and worth its \$130 price tag. Call 212-973-4909 or 800-234-4553 for more information or write: Trade Shows and Exhibits Schedule, 633 Third Ave., New York, NY 10017. Highly recommended.

Trend Spotting.: There was some sign of these things a year ago; now they're all the rage: the **flippy board**. This is a card with a set of AT-bus connectors on one side and a set of Micro Channel connectors on the other side, so that the card can be used in either system. Look for this design on **more and more** cards in the next year or two as most CAD software systems for board design incorporate the idea into their layout programs.

Buzzword to Avoid Dept.: Apparently the next generation of notebook computer is beginning to appear and will weigh less than 4 pounds. **Eager to create** a new category for

the obvious purpose of market segmentation, some makers are trying to **coin the term "sub-notebook."** I don't know about you, but it seems like a better idea to rename the current crop of **overweight** so-called notebook computers and call them laptops and keep the name "notebook" for the newcomers. After all, there is no such thing as a "sub" notebook. Most of the machines called notebooks are only called notebooks for **marketing purposes**. Since when does a "notebook" weigh 6 or 7 pounds? **Phonebook** is much more like it. End of diatribe no. 691.

Not wanting to
deal with Intel
and its backlog of
processor orders,
IBM will take
advantage of an
old deal with Intel
to make the 486
chips itself.

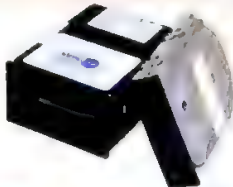
Genuinely Interesting Hardware Dept.: A Canadian company, Aview Technology of Toronto (phone: 416-922-6555, fax: 416-967-6063) has released a **nifty \$395 NTSC video card**, the DesktopTV, that plugs into a PC and can put any one of 119 channels of TV on a PC multi-sync screen. DesktopTV works in conjunction with a VGA or EGA card. The TV card uses a **new Hitachi video receiver module** that is about half the size of a deck of cards. I'm impressed. If you sometimes want to watch TV instead of the spreadsheet, then this is for you. The current model puts the whole image on the screen, not inside a small window. This is **perfect** for the office computer, if you ask me. It's not uncommon in modern Japanese offices to find that the computer monitors have TV capability. **It's time we catch up.** You can always say that it's for playing videodisks.

CD-ROM of the Month.: I was impressed with the latest release from Bureau Development of Parsippany, N.J. (phone 201-808-2700). Dubbed *U.S. History on CD-ROM*, this \$395 disk contains **100 books and 1,000 images**. Most of the books are public domain or government documents, but that does not lessen the value of this disk. This kind of inclusive package jammed with whatever you can jam on it will become **a trend** as the confused CD-ROM market still tries to find its place in the scheme of things.

CD-ROM Annoyance Dept.: The above *U.S. History on CD-ROM* reminds me of a **peeve**. We know it costs only a few bucks to stamp out a disk and I would hope that the publishers would do some **value-added retailing** and put the disk in a CDcaddy rather than in a cheap compact disk holder. The CDcaddy is now the common standard slide-in cartridge required by most of the newer CD-ROM players. These caddies protect the disk and make handling easier. All CD-ROMs should come **prepacked** in one of these things. This is especially true if the CD-ROM costs over \$100. Show some **marketing skills**, guys. ■

Name Brand Products. Rock Bottom Prices.

Hard Disk MicroKits



5.25" Hard Drives

	Drive Only	AT Kit	XT Kit
Seagate ST225 20MB, 65ms, MFM, HH	178	183	223
Seagate ST238R 30MB, 65ms, RLL, HH	189	194	238
Seagate ST250R 40MB, 68ms, RLL, HH	199	204	249
Seagate ST251-1 40MB, 28ms, MFM, HH	249	254	295
Seagate ST277R-1 65MB, 28ms, RLL, HH	269	274	309
Seagate ST296N 80MB, 28ms, SCSI, HH	399	404	449
Seagate ST4096 80MB, 28ms, MFM, FH	517	522	557
Seagate ST4144R 120MB, 28ms, RLL, FH	569	574	609
Seagate/Imprimis ST4182E 160MB, 17ms, ESDI, FH	949	INQUIRE	
Seagate/Imprimis ST4182N 155MB, 17ms, SCSI, FH	979	INQUIRE	
Seagate/Imprimis ST4350N 307MB, 18ms, SCSI, FH	1399	INQUIRE	
Seagate/Imprimis ST4384E 329MB, 15ms, ESDI, FH	1599	INQUIRE	
Seagate/Imprimis ST2383E 337MB, 16ms, ESDI, HH	1599	INQUIRE	
Seagate/Imprimis ST2383N 338MB, 16ms, SCSI, HH	1629	INQUIRE	
Seagate/Imprimis ST4766E 676MB, 16ms, ESDI, FH	2099	INQUIRE	
Seagate/Imprimis ST4766N 676MB, 16ms, SCSI, FH	2149	INQUIRE	
Seagate/Imprimis ST41200N 1050MB, 17ms, SCSI, FH	3899	INQUIRE	

3.5" Hard Drives

	Drive Only	AT Kit	XT Kit
K/Lok KL320 20MB, 40ms, MFM, HH	169	174	215
K/Lok KL330 30MB, 40ms, RLL, HH	179	184	229
Seagate ST138R 30MB, 40ms, RLL, HH	249	254	295
Seagate ST157R 50MB, 40ms, RLL, HH	275	279	319
Seagate/Imprimis ST1100 88MB, 15ms, MFM, HH	649	654	697
Seagate/Imprimis ST1162N 142MB, 15ms, SCSI, HH	779	INQUIRE	
Seagate/Imprimis ST1201E 177MB, 15ms, ESDI, HH	1029	INQUIRE	
Seagate/Imprimis ST1201N 177MB, 15ms, SCSI, HH	1049	INQUIRE	

MicroLab MicroKits Include:

- Hard Disk Drive
- Dual Drive Controller for XT Kits
- Mounting Hardware
- Bezel & Cabling
- Disk Manager Software for Drives 40MB and Up
- Comprehensive Installation Manual

MicroLab Hard Cards



8 Bit 20ns SCSI 16 Bit

Hard Card/20 20MB, 40ms	245	265	339	359
Hard Card/30 30MB, 40ms	269	289	359	375
Hard Card/50 50MB, 40ms	349	369	439	539
Hard Card/90 88MB, 15ms	699	719	N/A	829

MicroLab Hard Cards are complete "plug 'n play" high performance hard disk sub-systems. The hard disk and controller card are mounted in-line on a slimline chassis. Mounted in any open bus expansion slot, the unit saves valuable drive bay space for other peripheral devices while minimizing overall system power consumption. 5 minute installation!

Floppy Disk Drives

TOSHIBA



MITSUMI



360KB Floppy 5.25", Black or Beige Bezel	54
720KB Floppy 3.50", Black or Beige Bezel	59
1.2MB Floppy 5.25", Beige Bezel	68
1.44MB Floppy 3.50", Black or Beige Bezel	69

Hard Disk Controllers

WESTERN DIGITAL CORPORATION



MFM Controllers

Western Digital XTGEN2PLUS Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Western Digital 1003VMM2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	76
Seagate ST22-M Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	79
Western Digital 1006VMM2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	85

Western Digital 1004-A27X Dual Hard Disk Controller, 8-Bit, 3:1 Int	45
Seagate ST11-R Dual Hard Disk Controller, 8-Bit, 3:1 Int	48
Western Digital 1003VSR2 Hard/Floppy Disk Combination, 16-Bit, 2:1 Int	86
Seagate ST22-R Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	89
Western Digital 1006VSR2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	95

SCSI Controllers

Seagate ST-01 Dual Hard Disk Controller, 8-Bit, 3:1 Int	39
Seagate ST-02 Hard/Floppy Disk Combination, 8-Bit, 3:1 Int	45
Western Digital 7000FASST Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	299

ESDI Controllers

Western Digital 1007VSE1 Dual Hard Disk Controller, 16-Bit, 1:1 Int	155
Western Digital 1007VSE2 Hard/Floppy Disk Combination, 16-Bit, 1:1 Int	159

Monitors



AOC

NEC



TTL Monochrome 12", Amber, 720x350, tilt/swivel base	65
Amber Flat Screen 14", Amber, 720x350, tilt/swivel base	97
Page White Flat Screen 14", Page White, 720x350, tilt/swivel base	99
VGA Monochrome 14", Page White, 656x496, tilt/swivel base	119
CGA Color 14", 640x240, tilt/swivel base	189
EGA Color 14", 640x350, tilt/swivel base	275
VGA Color 14", 720x400, tilt/swivel base	299
VGA Multi-Scanning Color 14", 800x600, tilt/swivel base	369
Super Hi-Res VGA 14", 1024x768, tilt/swivel base	399
NEC 3D Super Hi-Res VGA 14", 1024x768, tilt/swivel base	649

Video Graphic Boards

MaxLogic

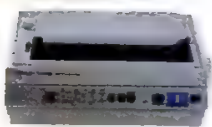


ML/MGP Monochrome graphic with printer port	25
ML/CGP Color graphic with printer port	28
Oak VGA VGA, 256K RAM, 800x600	79
Great-Tek VGA VGA, 16Bit, 256KB/512Exp. RAM, 1024x768	99
ATI VGA Wonder/256 VGA, 16Bit, 256KB RAM, 1024x768, OEM	169
ATI VGA Wonder/512 VGA, 16Bit, 512KB RAM, 1024x768, OEM	189



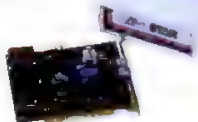
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Printers



Panasonic 1180 192cps, 80 col., 9-pin	159
Panasonic 1191 240cps, 80 col., 9-pin	219
Panasonic 1124 192cps, 80 col., 24 pin	279
Panasonic 1624 192cps, 132 col., 24-pin	349
Panasonic 4420 Laser, 8pp. per minute, 22 fonts	799
Panasonic 4450i Laser, 11pp. per minute, 28 fonts	1199
Panasonic 4455 PostScript Laser, 11pp. per minute, 39 fonts	1999
Star NX1001 144cps, 80 col., 9-pin	159
Star NX1000 Rainbow 144cps, 80 col., 9-pin	199
Star NX1500 192cps, 132 col., 9-pin	279
Star XR1000 300cps, 80 col., 9-pin	299
Star XR1500 300cps, 132 col., 9-pin	409
Star XB2410 240cps, 80 col., 24-pin	429
Star XB2415 240cps, 132 col., 24-pin	549

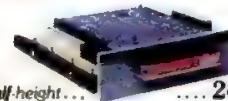
Modems



1200 Internal 1200/300 Baud Internal	47
2400 Internal 2400/1200 Baud Internal	75
2400 External 2400/1200 Baud External	89

All modems are Hayes compatible and come complete with user documentation. Internal models include terminal software.

Tape Back-Ups



Colorado 60 120/60/40MB (120MB-Compressed) Internal, half-height	245
Colorado 250 250MB Internal, half-height	349
Colorado 500 500MB Internal, half-height, w/host adapter	989

Tape Back-Ups come complete with data compression and back-up software. PS/2 Kit Add \$69. External Kits Add \$125. Tape Adapter Cards Add \$69.

Chips & Co-Processors



Intel 8087-3 5Mhz for XT systems	87
Intel 8087-2 8Mhz for XT systems	119
Intel 8087-1 10Mhz for XT systems	149
Intel 80287-6 6Mhz for 286 systems	119
Intel 80287-8 8Mhz for 286 systems	187
Intel 80287-10 10Mhz for 286 systems	209
Intel 80387-SX SX for 386 systems	279
Intel 80387-16 16Mhz for 386 systems	299
Intel 80387-20 20Mhz for 386 systems	349
Intel 80387-25 25Mhz for 386 systems	445
Intel 80387-33 33Mhz for 386 systems	549

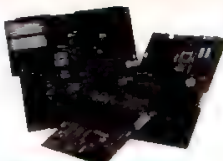
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Mice & Software



Genius GM-6X 3 Button, 200-800 DPI w/Dr. Halo	20
Genius GM-6000 3 Button, 350-1050 DPI w/Dr. Halo	35
Genius GM-F302 3 Button, 350-1050 DPI w/Dr. Genius	45
Genius GeniScan 400 DPI, Bus Card w/Dr. Genius	159

System Componentry



Motherboards

ML/XT-12 4.77-12Mhz, Turbo Motherboard w/CPU	59
ML/286-12 12Mhz, 4MB EMS Motherboard w/CPU	129
ML/386-16SX 16Mhz, Neat-SX Motherboard w/CPU	449
ML/386-20SX 20Mhz, Neat-SX Motherboard w/CPU	599

ML/386-25 25Mhz Motherboard w/CPU	639
ML/386-25 Cache 25Mhz, 64KB Cache Motherboard w/CPU	799
ML/386-33Cache 33Mhz, 64KB Cache Motherboard w/CPU	999
ML/486-25 25Mhz, Cache Motherboard w/CPU	1799

All MicroLab Motherboards come with comprehensive user documentation and set-up utilities.

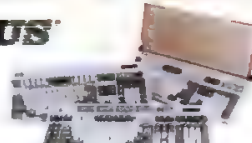
System Componentry



System Cabinetry

ML-XT Case & Power Supply XT Slide, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 150W Power Supply	69
ML-Baby AT Case & Power Supply Baby AT, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	89
ML-PS/2 Case & Power Supply PS/2, Slim Workstation, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	95
ML-Mini Upright Case & Power Supply Mini Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 200W Power Supply	99
ML-Full Upright Case & Power Supply Full Tower, Turbo/Reset Switches & Power, Disk and Turbo LED's plus 230W Power Supply	175

MicroLab system cases are ergonomically styled, two-tone units and come complete with speaker, generous expansion parts supply and 4-lead power supplies.



Keyboards

Focus FK-2001 101-Key, true tactile "click" response, mechanical Alps switch, hinged dust cover/copy holder	49
Focus FK-3001 111-Key, true tactile "click" response, mechanical Alps switch, built-in solar-powered calculator	59
Focus FK-5001 130-Key, true tactile "click" response, mechanical Alps switch, built-in battery operated calculator, both top and left-side 12-key function key layouts, keyboard templates and holder, turbo switch	79

Add-On Cards

FDC-2 Dual Floppy Disk Controller	15
AT I/O Parallel, Serial & Game Ports	19
XT Multi I/O Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports	29
FDC-2 Multi Two FDC (360/1.2/720/1.44)	29
FDC-4 Multi Four FDC (360/1.2/720/1.44) Combo	39
XT High Density Multi I/O Dual Floppy Disk Controller, Clock-Calendar, Parallel, Serial & Game Ports	59

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You get what you don't pay for.

► Introducing the NEC UltraLite™ 286F notebook computer. The best value in notebooks.

Buy a typical notebook computer and you get exactly what you pay for.

A typical notebook computer.

Buy the Ultra-Lite 286F notebook, however, and you get considerably more than you pay for.

► Atypical screen

The UltraLite 286F screen, for instance. Instead of the usual blue LCD, you get a black and white LCD double scan CGA screen. So there's greater contrast for optimized text readability. In fact, text fonts appear as clear as they do on a VGA LCD screen.

► Atypical battery life

You can use the UltraLite 286F for virtually an entire coast to coast flight, thanks to a battery life that's twice as long as most other notebooks'.

► Atypical proportions

Speaking of getting around, the UltraLite 286F is actually small and light enough to fit comfortably in your briefcase.

► Atypical for anyone but NEC

You also get standard features like an internal 3.5" floppy disk drive in addition to a 20MB hard disk drive. An 80C286 processor running at 12MHz with 1MB of RAM expandable to 5MB. Not to mention connectivity options including serial, parallel, CRT and external disk drive ports.

In short, it's totally unheard of for anyone else to give you so much in such an affordable computer.

But for NEC? It's very typical.

For product literature or location of your nearest dealer call 1-800-NEC-INFO.



CIRCLE 395 ON READER SERVICE CARD

Jim Seymour



Building the Right PC for Tomorrow

While faster speeds and greater throughput are important, today's PCs have plenty of room for improvement.

Last issue we looked at some of the things that are wrong with today's PCs. This time, let's look at what could be improved in the next round—in other words, what it would take to build a better, more ergonomically sound PC for tomorrow.

The important improvements fall into four areas: better displays, less noise, more humane keyboards, and more compact designs.

The display is a good place to start. Getting rid of screen flicker is the most important step, but the trend seems to be going the other way. When IBM introduced its new 8514/A high-res display standard four years ago, it went *backward*, to flickery interlaced video. We assumed even IBM would get that right next time. But when Big Blue's proposed replacement, the new XGA standard, appeared on the PS/2 Models 90 and 95 last October, it *still* only supported interlaced video at its primary 1,024- by 768-pixel resolution. For shame, IBM.

Eliminating glare on the screen is almost as important as eliminating flicker. Effective antiglare coatings help, but a more fundamental improvement is a change toward flatter screens. The bug-eyed, convex-face displays that we use pick up reflections all around us, and overhead as well. Flat-screen displays, on the other hand, collect far fewer annoying reflections. Going to a flat (or at least, *flatter*) display brings other benefits, such as less distortion at the edges of the screen, but the reduction of glare is the most immediate and dramatic change.

Beyond CRT-based displays, we can look forward to thin, bright, flat, high-resolution LCD panels. Ergo will start shipping one to owners of Brick PCs, for example. See one and you'll want to take it home: Its Sharper Image look aside, Brick's flat panel takes up much less desk space and offers an attractive display for long hours of work at the computer.

Quieter PCs are important, too. Today's PCs often are noisier than their predecessors:

many have two fans, not one. Add the fans in printers and other devices—in some monitors, for example—and the sensation of sitting at the end of the runway in a turboprop is very real.

The concatenation of fan noise across an office—the noise of your fans added to those in another 50 PCs—is a real quality-of-work-space issue. When we add voice technology to our PCs, we'll be even more sensitive to extraneous ambient noise. The time to get rid of fan noise is now.

Here, too, the Ergo people have shown the way: By using a large, flat thermal-gel pouch in contact with both the motherboard and also the unit's case, they eliminate the need for a fan. Heat is efficiently transmitted to the case, which serves as a huge heat sink, dissipating the heat into the room.

This kind of tight, close-coupled chassis design runs precisely counter to conventional wisdom on PC cooling, which has always demanded lots of open space for airflow, but it works extremely well.

Keyboards are an area of concern, too. We read a lot these days about carpal-tunnel syndrome. An inflammation of the nerve bundle that passes through the wrist and into the hand,

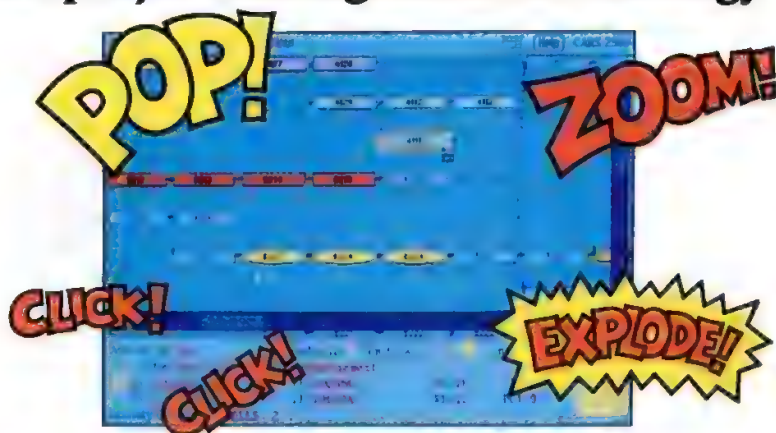


ILLUSTRATION: STEPHEN SWENY

CTS is agonizing and can be permanently disabling. New keyboard designs are required to overcome carpal-tunnel problems.

One approach that has gotten a lot of attention uses what amounts to a "cracked" keyboard: broken in two through the centerline of the alpha keys, it rises in an inverted V. It's a far more natural, comfortable position for the hands to face each other at a 45-degree angle than for them to be rotated to a flattened position, as we

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#6

Jim Seymour

must do with conventional keyboards.

Whatever keyboard design emerges as the new standard, the need for input from kinesiologists is clear.

Finally, compactness counts more than ever in system design. Many of us find our workspaces shrinking. In today's open-plan offices, built from many individual cubicles, our workspace may be better-defined but is also usually smaller. Put a PC, monitor, keyboard, and printer in there, and perhaps an external CD-ROM drive, maybe a scanner . . . and that limited workspace is soon pretty crowded.

One way to relieve that crowding will be evident in so-called "hydra" units due later this year: combination laser printers, fax machines, copiers, and scanners. That kind of high-level integration is perfectly suited for the PCs and peripherals of tomorrow. Hydras take less space, use less electricity (and thus throw off less heat to be vented and replaced by cooled air), and cost less, too. They also offer the promise of better performance through tighter functional integration.

A common response to pleas for sanity in computer design is that we're asking too much of the manufacturers: A lot of our problems are not of their making. Bad office lighting, for example, contributes to reflections and glare on displays. Putting even the best-designed keyboard atop a 29-inch high desk guarantees wrist problems. And bad desks and chairs contribute to physical stress.

Fair enough. But in any given physical setting, better-designed PC equipment will always make a pronounced improvement in our comfort, satisfaction and, probably, safety.

Legal initiatives, such as San Francisco's proposed ordinance requiring safer and healthier workspaces, are likely to produce a rich market for replacement units. The resulting more-rapid-than-usual turnover of PCs will offer those manufacturers who see more civilized PC design as an opportunity, not a burden, a quick means of recouping their R&D costs. And a chance to emerge as leaders in the next generation of PCs.

One of the truisms of industrial design is that "good design doesn't cost, it pays." In PCs, that's likely to be exactly the case—for employers, employees, and manufacturers. ■

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*Byte Exec benchmark, 1000 iterations on 20 MHz 386.
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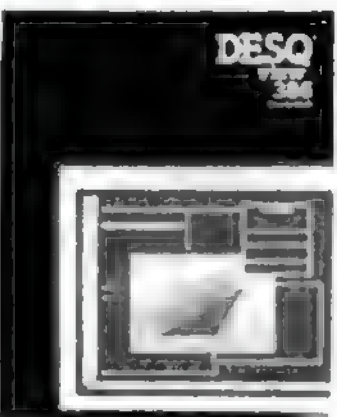
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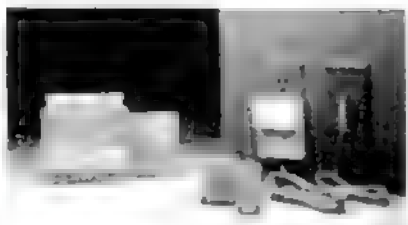
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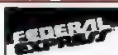
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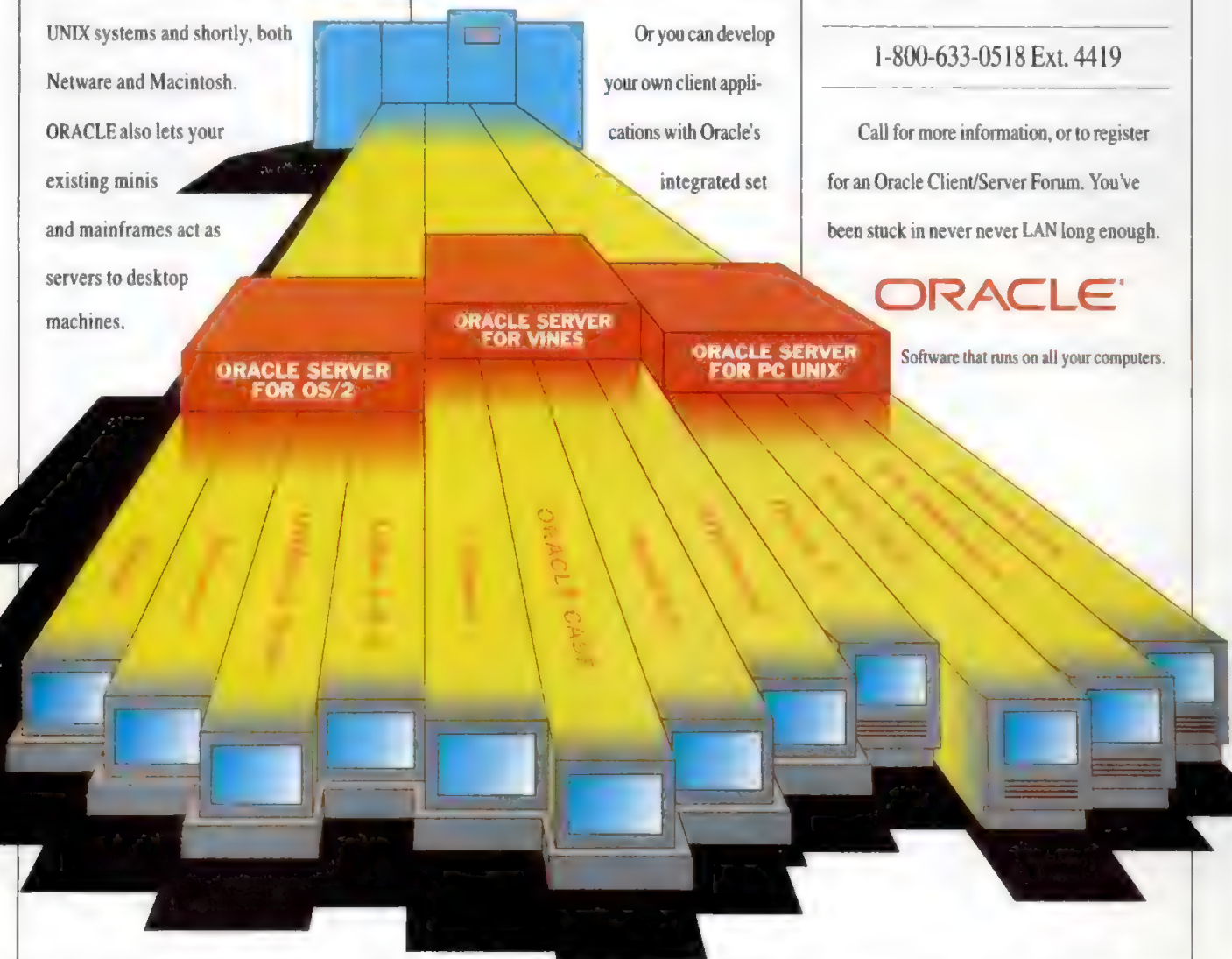
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Easier To Use?

Industry experts await the day when more powerful systems run software that is significantly easier to use. They have a very long wait, indeed.

Put together a panel of personal computer industry executives. Ask them to talk about the future of software. You are almost certain to hear them say: "Our challenge in the years ahead will be to make computers and software easier to use."

It borders on becoming some sort of standard ritual incantation. The litany goes on from there. It tells of how computers are still used by only a portion of the population. It tells (particularly if vendors, resellers, or the financial community are a significant element in the congregation) of a promised land of renewed industry growth once the "ease-of-use" problem is solved.

From that point onward, matters are a bit murkier. Depending upon who is preaching (and what his or her company's products are) the description of the path to the promised land of "ease of use" may vary. Certainly,

that description will be characterized by vague generality rather than crisp specificity. It will often be accompanied by statements like: "We need to use the increasing power and complexity of systems to simplify the user interface and make computing power accessible to unsophisticated users." And so forth.

Just how "we" are going to achieve these lofty goals varies widely. Current candidate vehicles of salvation include graphical user interfaces, multimedia, pen-based systems, programming for nonprogrammers, object-oriented something-or-others, voice recognition, and a host of others.

That is simply the contemporary set, however. A few years ago, the list would have prominently featured natural language recognition and artificial intelligence. These two, having lost an awful lot of money for venture capital and other investors, are currently out of favor.

Which makes the point that while the proposed means of salvation have changed, the basic litany has been with us for a while. The gospel of improved "ease of use" expanding the market to "people who don't use computers (yet)" and creating "renewed growth in the industry" dates back at least to the mini-slump that was experienced by the personal

computer industry at the end of 1984.

So perhaps it is time to pose the critical question: Is this a true religion? Or, rather, is this religion true? Is improved ease of use really attainable and will it create a new spurt of double digit industry growth as previous nonusers become computer users?

The answers are no, no, no, and no. Let's consider why.

Immediately, one should be suspicious of both the divergent directions in which the path to salvation is said to lie, and the high degree of generality in the description of said path, whatever its claimed direction. Close examination of the proposed paths reveals significant limitations.

THE EASY-TO-USE INTERFACE

Consider, for example, the way of the GUI. The graphical user interface has been heralded by many as the primary road to industry salvation by "ease of use." The facts, however, suggest otherwise.

It is not my intention to suggest that a well-designed GUI is not desirable, nor that it is incapable of making computers easier to use. The Apple Macintosh has unquestionably



provided access to computers for many people who were not (or would not have been) comfortable with a DOS "C:>" prompt. If, however, Apple's computer were really capable of delivering computing power into the hands of the multitudes, the multitudes would already have bought them, the promised land of a computer in every pot (well, in the hands of every human who might conceivably use one, anyway) would already have been reached,

William F. Zachmann

and the pool of "people who don't use computers (yet)" would have long since evaporated.

"Aha," some might say, "but the Macintosh has always been a proprietary system and a tad pricey. What was really needed was a GUI supported by many

vendors." That argument isn't terribly persuasive, since it isn't obvious why "the rest of them" should have failed to buy the Mac simply because it was proprietary and (until recently) cost more.

Nor does the recent success of *Windows* 3.0 prove otherwise. While *Windows* undoubtedly brings many of the benefits of the Apple Macintosh to users of IBM and compatible systems, ease of use is not really one of them. The Macin-

tosh still remains much easier to use than *Windows* 3.0.

In fact, *Windows* not only falls short of the Macintosh with regard to ease of use, but in many respects *Windows* is far more difficult to use than plain old DOS. True, once set up and running smoothly, *Windows* offers at least some of the ease-of-use features of the Macintosh. But getting *Windows* set up and running smoothly can in fact be a daunting experience for many users; one that makes DOS seem trivially easy, by contrast.

For those unlucky enough to have plumbed the mysteries of the WIN.INI or SYS.INI files in order to get *Windows* 3.0 running on their system, for those into whose lives the demon "unrecoverable application errors" must fall, for those whose CONFIG.SYS file did things that angered the gods of Wynne Three, (and for the corporate personal computer support people who've had to bail out all of the above) *Windows* has been anything but easy to use.

That is not an exception but the rule. In reality, software is not getting easier but typically more difficult to use. The esoteric complexities of *Windows* 3.0 are echoed in other software domains, as well. The latest and greatest word processing and spreadsheet programs, for example, jam-packed with advanced features and capabilities, are normally *more* difficult to master than their predecessors.

Migration to the GUI environment and the rich array of fonts and styles that naturally follow increases any user's choices and makes programs more difficult to learn and use. The ability to create "hot links" between applications via DDE or other means, to access remote data via networks, and similar capabilities compound the complexity even further. All this, however, may appear simple by comparison to what we'll face once multimedia really takes off!

No, despite the pious incantations routinely uttered on industry panels, software isn't going to get fundamentally simpler and computers aren't going to get fundamentally easier to use. That is the reality. Each advance in ease of use will be matched by increased complexity in what we do with computers.

That's not necessarily a bad thing; it's likely an essential characteristic of an advancing technology. We shall be able to do more, more-complex, and ultimately more-useful things with computers. Therein may lie our salvation. ■

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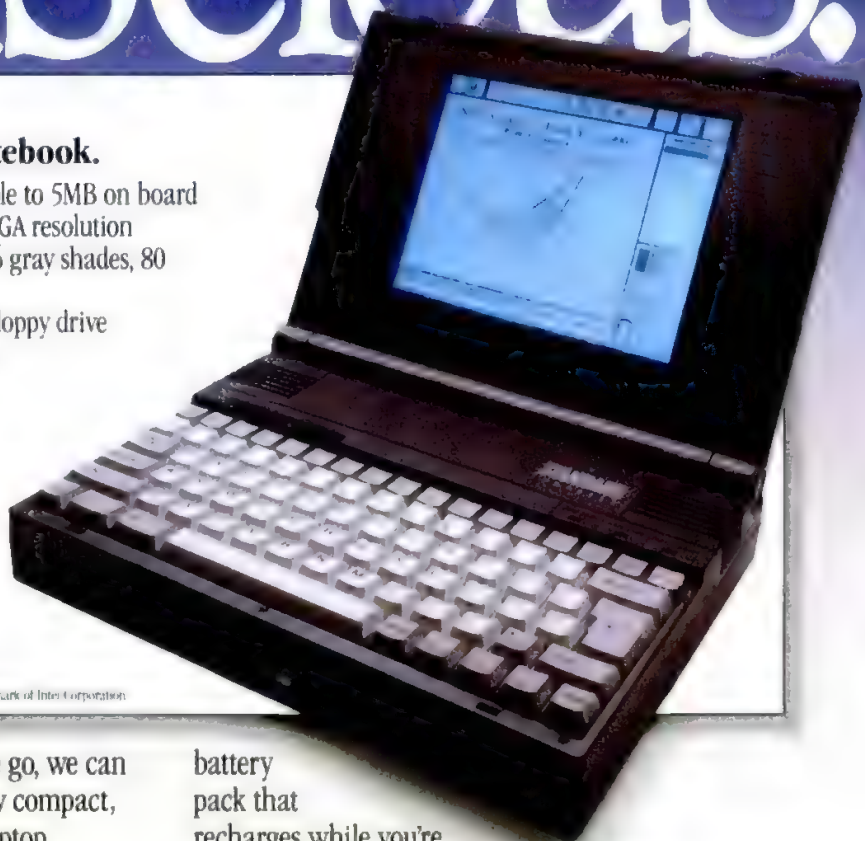
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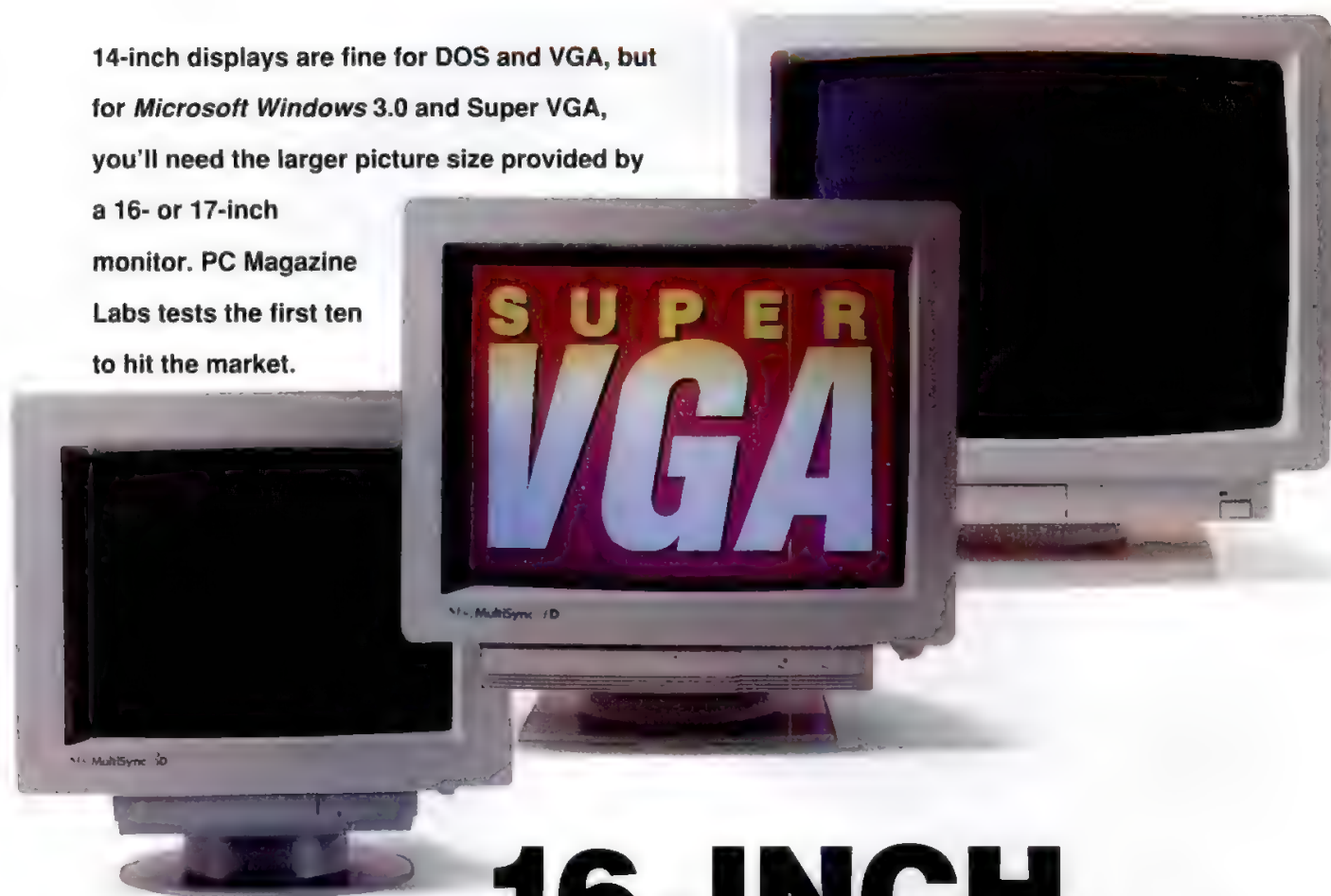
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14-inch displays are fine for DOS and VGA, but for *Microsoft Windows 3.0* and Super VGA, you'll need the larger picture size provided by a 16- or 17-inch monitor. PC Magazine Labs tests the first ten to hit the market.



16-INCH MONITORS

Sized for Super VGA



You've bought your 386 with 4MB of RAM and a 14-inch monitor; you've installed *Microsoft Windows 3.0* and even popped in a high-tech cutting-edge Super VGA graphics card. You switch it on, and what do you get? A little screen filled with tiny doodles, and a bad case of eyestrain. Sure, you can step back to VGA, but then why did you spend the money on that high-resolution adapter? There's only one solution: You need a larger monitor.

**TOO MANY WINDOWS?
GET A LARGER SCREEN**

You need a monitor large enough to let you see the true multitasking activities for which you bought *Windows* in the first place. As long as you need to look at only one application at a time, VGA resolution is fine. If you want to see simultaneous applications, a higher-resolution display system lets *Windows* display each character in a smaller area, giving you more characters (and more windows) per screen. (For more information on how video affects *Windows* performance, see "Boosting Video Performance Under *Windows* 3.0," February 26, 1991.)

While higher resolution makes it possible to display smaller characters, it doesn't ensure the characters will be easy to read. Increase the number of pixels by 56 percent (such as when you go from VGA to Super VGA) and you shrink the character size on-screen by about 20 per-

cent. In terms of typography, this move is like going from a 10-point font (which is a standard size) to an 8-point font (which crosses into the territory known as "fine print").

How do you solve this small-print dilemma? Move up to a bigger screen. Monitors are measured diagonally between tube corners (the actual image-display area is smaller). By increasing your monitor size from 14 to 17 inches, you actually increase the display area by about 50 percent—just enough to keep up with higher *Windows* resolutions. The end result is that you see characters the same size as before, only more of them.

WHAT'S IN AND WHAT'S OUT

To help you find your ideal monitor, we evaluated ten mighty monitor candidates. To make it into this roundup, each display had to have a 16- to 17-inch diagonal screen and produce at least an 800-by-600 resolution. The following ten monitors arrived in time to be reviewed here: Dell's Graphics Performance Display 16C, Hewlett-Packard's HP D1188A, the Idek MF-5117, IOcomm's ThinkSync 17 CM- 7126, Mitsubishi's Diamond Scan

16L and HL6615(TK), the Nanao FlexScan 9070U and FlexScan 9080i, the NEC MultiSync 4D, and the Philips FC17AS.

Of course, many monitor manufacturers are now coming out with models that fall into this category. Some monitors were going into production as we went to press, but the companies couldn't get units to us before our cutoff date. By the time you read this, or soon after, you should look for 16- to 17-inch monitors from vendors such as CTX International, General Business Machines, Goldstar Technology, MAG Computronic, Princeton Graphic Systems, Tatung Co. of America, and Taxan America.

As you read the following reviews, keep in mind the different factors that should guide your decision, most of which take on special significance when you

consider a monitor's size and resolution.

**SOME MONOLITHIC
MONITOR LIMITATIONS**

If 16- or 17-inch monitors are good, why aren't even bigger monitors better? While there are a number of reasons, one stands out: As size goes up, so does cost.

The Dell Graphics Performance Display 16C has a list price near \$1,000, but most of its competitors cost between \$1,500 and \$2,000, and some are even higher. A successful display combination will cost about \$1,000. The NEC MultiSync 4D, for instance, has a street price around \$800. Couple that with a new-breed Super VGA card, discounted to under \$300, and you get mighty close to that magic thousand-dollar price. (For more reviews of Super VGA monitors, see "Super VGA: Monitors with More," May 15, 1990.)

The 20-inch and larger monitors cost even more. As you increase the display size, engineering the monitor to control the electron beams accurately becomes more difficult; the endeavor requires more-rigorous design and higher-quality components. All this adds to the cost. If you

have an expensive CAD installation for which the extra resolution and display area are essential, you may be able to justify the extra expense. If so, check out the 20-inch Nanao 9400, which took home an Editors' Choice award in our 1990 look at high-resolution monitors ("1024 Monitors," April 10, 1990). Also, if you're into presentation graphics, then look into buying a 25-inch or larger display; we'll be reviewing these high-res monsters in an upcoming issue. But for simply running standard desktop applications, the largest monitors are a bit extravagant. At the moment, the 16- and 17-inch sizes are at the top of the price range for general-use monitors.

Also, even if you have the dollars available, you may not be able to afford the space. Most of the monitors we reviewed have tubes that are 17 to 18 inches deep, which is at least 3 inches more than most 14-inch VGA displays. And these aren't lightweight units you can glibly shift around on your desktop. While a typical 14-inch VGA display weighs less than 30 pounds, these monitors weigh between 40 and 50. Going beyond the 16- or 17-inch mark means assigning a significant amount of workspace real estate to your display, and many desks simply aren't big enough to cope comfortably. All this makes the 16- to 17-inch display the new mainstream for practical as well as financial reasons. But how to go about buying one?

SELECTING YOUR SCREEN

First and foremost, consider what resolutions the monitor will support. Check the features table to get this information quickly. This is one of the rare instances where it can make sense to pick a unit with fewer capabilities than its competitors offer.

A monitor's ability to project any number of pixels across the screen is directly related to the speed with which it can move the electron beam horizontally. This is specified in terms of kilohertz (kHz). A standard VGA signal requires a 31.5-kHz horizontal scan frequency capability. Noninterlaced 800-by-600 mode, referred to as Super VGA, must be able to scan frequencies between 35 and 48 kHz, while noninterlaced 1,024-by-768 mode requires a 48- to 60-kHz horizontal scan rate capability.

If you don't intend to go beyond 800 by 600, don't waste your money on monitors that can handle higher frequencies. You

By increasing your monitor size from 14 to 17 inches, you actually increase the display area by about 50 percent.

might be tempted to buy a tube with better specifications for an overall better picture, but our test results don't indicate that higher specifications always mean an improved image at lower resolutions. And if you think that you might eventually move your monitor to a new computer,

Make certain that your monitor can automatically sync to the different signals it receives within its resolution range.

keep in mind that monitors tend to stay with their original systems.

VERTICAL SCAN AND DOT PITCH

Two more specifications to consider are the monitor's *vertical refresh rate* and *dot pitch*. Most VGA and Super VGA adapters produce a 60-Hz vertical refresh rate (the image is repainted 60 times a second). Some cards produce a lower rate for 800-by-600 mode, and you'll want to make certain that your monitor can accept the slower signal if you already own a display adapter. (All the monitors in this review can go as low as 50 Hz, which should be adequate for all major adapters on the market, but take a glance at our features table to make sure.) On the other hand, slower vertical refresh rates increase screen flicker. If you're also buying a new adapter, get one of the newer designs that can produce a 70-Hz vertical refresh rate. (All of the monitors here can handle this rate as well.)

Dot pitch is a concept many people confuse with pixel size. It describes how far apart the individual phosphor dots are on the screen. The smaller the dot pitch, the finer the image's "grain." Many VGA monitors have dot pitch measurements of 0.33 or 0.31 mm., but this can be too coarse for higher-resolution images. We recommend a monitor with a dot pitch smaller than 0.29 mm.; smaller is generally better. After checking the dot pitch and vertical scan specifications in the features table, don't forget to examine the monitor's frequency sync specifications.

COVER STORY

16-INCH MONITORS

DON'T GET SUNK OVER SYNC

You'll want to make certain that your monitor can automatically sync to the different signals it receives within its resolution range. There is still some variation between different high-resolution adapter cards in terms of the signals they produce. It's simply not enough to get a monitor that can tune to only a few of

these combinations.

Some monitors adjust the picture size and location with each frequency change, even though they automatically sync to the signal. Others provide digital circuitry to store the settings for different display modes. The digital solution is better, since it generally means less fiddling once you store them the first time. Some of the procedures for storing these settings can be tricky, so pay close atten-



EDITORS' CHOICE

- Idek MF-5117
- NEC MultiSync 4D

If you use *Microsoft Windows 3.0*, you may have noticed that your 13-inch monitor just isn't making the grade. Today's graphical environments demand larger screens. That's why we've chosen to examine monitors with a 16- to 17-inch diagonal screen size. The ten monitors reviewed here represent the first of this new breed of mainstream display. Capable of VGA, Super VGA, and 1,024-by-768 resolutions, these machines are ideal for *Windows* applications.

With their larger screens, these monitors can display characters in Super VGA mode under *Windows* at the same size as VGA characters on standard 13-inch screen. You get the same readability as with VGA, but with more windows on your screen at one time; when you're talking about *Windows*, the more screens, the better. And compared with 19-inch or larger monitors, these new midsize displays are more affordable and take up less desktop real estate.

All but one of the ten 16- to 17-inch Super VGA monitors reviewed here performed acceptably on PC Magazine Labs' performance tests. Two products deserve the distinction of Editors' Choice awards: the Idek MF-5117 and the NEC MultiSync 4D.

We found that the image displayed by the \$1,795 Idek MF-5117 sparkled a little more brightly than its competitors. It had a wider range of signal compatibility than any other monitor (all the way from Hercules to noninterlaced 1,024 by 768), excellent color reproduction, analog and digital input capability, and even convenient control positioning. We found it a high-quality product at a competitive

price.

The \$1,499 NEC MultiSync 4D coupled a wide array of features with an incredibly low \$800 street price. A solid performer and a previous Editors' Choice winner ("1024 Monitors," April 10, 1990), its low street cost is made possible by NEC's wide distribution effort: The 4D has the largest availability of any 16- or 17-inch display. This monitor combines a wide range of input signal compatibility, a great image, solid and well-designed construction, and true affordability.

The only tested monitor we have reservations about recommending is the Philips FC17AS. This display suffered from convergence difficulties, sparse packaging, lack of stored settings, and a \$2,695 list price (the second highest here).

Some final hints: Unless you've got a specific application in mind, don't pay extra for a monitor that's capable of resolutions beyond 1,024 by 768. There are as yet no standards above this and very little software support. Also, remember to pay more attention to your prospective monitor's features than to its test scores. Very few of the testing anomalies we encountered were visible to the naked eye. And finally, if none of the machines shown here tickles your fancy, don't despair. As we went to press, several manufacturers announced products in this category, including CTX International, General Business Machines, Goldstar Technology, MAG Computronic, Princeton Graphic Systems, Tatung Co. of America, and Taxan America.



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high refresh rate
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H: 30-64kHz V: 50-90Hz
VGA, 8514/A and Mac II Compatible

tion to the design and function of the controls described in the reviews.

A related feature is called *autosizing*. With it, a monitor can automatically maintain a constant image size across modes. Most of the monitors in this article used preprogrammed factory settings to achieve this effect in certain modes and specific frequencies—most often VGA and Super VGA. Many also allow room for a number of user-adjustable stored settings; after recording the setting in the monitor's memory, you don't have to reach for the position dials whenever you enter an often-used resolution.

Image quality is an obvious and worthwhile factor, but where the signals come from and how they get to your monitor can be just as important.

WHERE THE PICTURE COMES FROM

Every monitor in this group offers five coaxial BNC cable connectors—the standard for high-quality analog RGB signals. BNC connectors offer the maximum flexibility in terms of being able to accept signals from different sources.

The five components of an RGB analog signal are the signals for the three color beams (red, green, and blue), the horizontal sync signal, and the vertical sync signal. Some sources use only three wires; red and blue are sent by themselves, and a composite sync signal is added to the green signal. Some adapters use four wires, three for the color signals and the fourth for the combined sync signal. The third possibility is to separate the horizontal and vertical sync signals from the others and send them over two separate wires, thus arriving at the five coaxial connections we see on these monitors. Coaxial cable has the advantage of lower signal loss than you would get from a standard video cable and D-sub connector; theoretically, these connectors should result in better on-screen images.

People want flexibility, however, and you'll see on the features table that while some of the monitors here offer only the BNC connectors, others give you more choices. The most common is an analog connection using the typical 9-pin (or mini 15-pin) D-sub connector seen on smaller VGA monitors. This offers the advantage of using a standard video cable; in the course of our testing, we discovered that finding an extra BNC coaxial monitor cable is not always a simple task.

For the ultimate in variety, some of

these displays even offer a digital signal input. These TTL (transistor-transistor logic) circuits let you hook up an older display adapter that uses a digital instead of analog signal, such as an EGA card. We even found a few front-panel switches that allowed switching between the different connectors, which means you can keep your monitor hooked up to multiple signals for on-the-fly toggling.

None of the monitors offered a com-

Most monitor images are slightly curved, but as long as the distortion is only one or two pixels, you're not likely to see it.

posite video input (a standard broadcast television signal, for example), but that's not surprising, since none offer a horizontal scanning frequency low enough to accommodate such signals. Don't plan on using one of these displays with your VCR when you're not using your computer. Another feature missing from all these displays is an output video port through which you could send images to other, usually larger, monitors or image display mechanisms. The only ones that come close are Mitsubishi's Diamond Scan 16L and HL6615(TK). These monitors have switches that let you terminate a signal or pass it along (with the aid of standard T-connectors, which you'd have to purchase separately).

CURVEYOUS SCREENS

Another factor to consider is the shape of the screen. Most CRT (cathode ray tube) designs are based on a large tube with a curved front. For a number of reasons, it's easier for a beam to play across the inside of a curved surface than a flat one, mainly because the phosphors are about the same distance from the electron guns. Many users find that the image on a flat screen looks much better, however. The Zenith FTM VGA monitor is one famous example.

Most tube manufacturers, though, rely on the traditional shape where the surface is approximately the shape of a section cut from a sphere. Some units are flat in one dimension; the surface is more the shape of a cylinder slice. The reviews will tell you the shape of each screen. If all other

factors are equal, you're likely to find that the flatter the screen, the better the image. Image quality, of course, finally leads us to performance.

HOW WE TESTED

In terms of performance, you'll find that all the monitors performed fairly well on our tests. In general, performance was so similar that you probably won't be able to detect any differences. On the other hand, if your work requires truly high-resolution graphics, checking out the most ca-

pable of the bunch is a good idea.

The *aspect ratio* (the proportion of a pixel's width to its height) is the same in VGA and Super VGA modes; individual pixels should be as tall as they are wide. We measured the widths of single-pixel-thick horizontal and vertical lines to see whether they match. We also measured *pincushioning*, which describes how curved the image is at the edge of the screen. Most monitor images are slightly curved, but as long as the distortion is only one or two pixels, you're not likely to see it. Some monitors offer a pincushioning adjustment so you can fine-tune the image yourself.

We also looked at how each monitor handled image stability by measuring how much it shifted over a period of time. We looked at problems like *jitter*, the measure of how stable an image is in half-second intervals. Large amounts of jitter may be visible to the user. Related to jitter is *swim*, which is measured in intervals between 0.5 and 30 seconds. Swim movements that exceed the dot pitch of the monitor can cause the image to waver. Finally, we looked at *drift* by measuring long-term beam motion over a 30-second period. Too slow to be perceptible by users, drift can cause registration problems with film recording systems or overlays. Most of the monitors scored well in all these categories.

Another important performance factor is *convergence*. The monitor creates an image by using three separate electron beams to light up the red, green, and blue phosphors. In order to produce clean

colors—including a crisp white—the beams must overlap precisely. If one or more beams are out of alignment, you'll see a colored halo along the edges of a white character on a black background.

Convergence varies between units of a given model and also between image areas on a single monitor: An image that is perfectly converged at the center of the screen and in one corner might not be in the other corners. Convergence problems tend to show up most frequently in the corners. To get a good image, convergence must be accurate within fractions of a pixel at all on-screen locations. This was one of the few tests where some noticeable differences appeared between monitors. For more information on our testing process, see the benchmark test results and the accompanying captions.

Related to color and convergence is *transient response*, which concerns how quickly the CRT can turn the electron beam on and off. Bad transient response can dull adjacent colors. It can also cause a visual phenomenon called *roping*; lines afflicted by this appear in a twisted or rope-like fashion instead of a solid line.

DON'T FORGET THE BASICS

After examining all these important technical specifications, don't forget to pay attention to some mundane but nonetheless important features, such as the location of the controls (mentioned in the reviews). You shouldn't need to make many adjustments to a monitor after the initial setup, but if you do, it can be more than inconvenient to grope behind the case in order to tune your image. Make sure that any often-used controls (such as the power switch or text selector) are located at or near the front of the monitor for easy access. The more controls are located in the rear, the more you'll be stretching your arms and neck.

You'll find other control features that separate these monitors as well. Some offer switches that allow you to select the colors of a text screen, such as green on black or white on blue. And most come with tilt/swivel bases. While these issues should not primarily influence your decision, such extras might make the difference when you're choosing between two evenly matched finalists.

No matter what your selection criteria, you'll find at least one tempting monitor in the pages that follow. If you use *Windows*, you have good reason to cast off the limits of 80-by-25 text mode displays.

Look to these 16- and 17-inch high-resolution monitors for bigger, sharper, and more-numerous windows for your PC.

DELL COMPUTER CORP.

Dell Graphics Performance Display 16C

by Bruce Brown



Dell Graphics Performance Display 16C, \$1,099.

Dell's \$1,099 high-resolution Graphics Performance Display 16C is generally bundled with the company's noteworthy computers. The monitor, actually an OEMed version of the Nanao 9070S, is one of the few displays in this roundup that offers you a choice between analog and digital input modes. The GPD-16C is inexpensive, sturdy, and quite a bargain.

The 42-pound GPD-16C has a 16-inch display tube and comes with an 84-inch removable power cable, a tilt/swivel base, a 9-to-9-pin 70-inch interface cable, and a 9-to-15-pin adapter.

The monitor is compatible with most major PC video modes, including both interlaced and noninterlaced 1,024-by-768. The screen's maximum resolution is 1,280 by 800, although that's just the screen's maximum, not a mode supported by adapters or software.

On PC Magazine Labs' benchmark tests, the monitor did well on both the measured performance tests and on more subjective observations. The only area where you might want to make adjustments, though, is when you use software that calls for either of two 640-by-350

modes—the screen doesn't resize to adjust for the new mode.

TTL ABILITY

A nice touch is the monitor's ability to switch between TTL and analog modes. In TTL mode, the video bandwidth is 30 MHz, while in analog mode it jumps to 50 MHz. Vertical scanning frequencies vary from 50 Hz to 80 Hz and horizontal frequencies from 20 kHz to 50 kHz. The GPD-16C has a 0.31-mm. dot pitch and uses short-persistence phosphors.

On the back of the GPD-16C's case is a single 9-pin port and a set of RGB BNC connectors. The separate-syncing RGB ports can use 3-, 4-, or 5-wire syncing combinations.

LOGICAL CONTROLS

Besides the input ports, the back of the GPD-16C's case sports a VGA mode switch, an 8/16/64-color mode switch, a TTL/Analog switch, and three image-quality adjustment controls for focus, convergence, and side pincushioning. Controls that are more commonly used are on the bottom front of the case: the power switch, contrast and brightness controls, horizontal and vertical size and positioning controls, and a combination text/color and text hue mode switch, which lets you choose between color mode and white or amber text.

A D-sub/BNC switch, which lets you select an input port, is an extremely convenient way to simultaneously hook this monitor to two computers, one via the D-sub connector and the other through the BNC wires.

While you can adjust many image features, all video mode interpretation (except for interlaced 1,024 by 768) is



FACT FILE

Dell Graphics Performance Display 16C

Dell Computer Corp., 9505 Arboretum Blvd., Austin, TX 78759-7299; 800-937-1470, 512-338-4400.

List Price: \$1,099 (tilt/swivel base and cable included).

Requires: Hercules, MCGA, VGA, Super VGA, or 1,024-by-768 graphics adapter.

Diagonal Screen Size: 16 in.

In Short: The Dell 16C is a respectable 16-inch high-resolution color monitor with a passable dot pitch of 0.31 mm. and a maximum resolution of 1,280 by 800. It is sold by a mail-order vendor with one of the best reputations in the industry for service and user support.

CIRCLE 944 ON READER SERVICE CARD

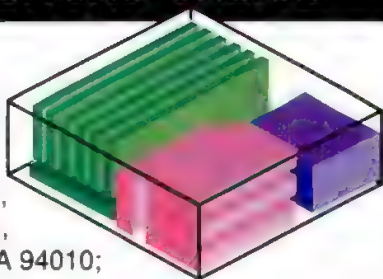
A Winner.

We didn't say it.
PC Magazine did.



Tangent 386SX/20

Tangent
Computer, Inc.,
303 Beach Rd.,
Burlingame, CA 94010;
(800)223-6677,
(415) 342-9388.



List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, VGA monitor, \$1,644; with 2MB RAM, 60MB hard disk, DOS 4.01, \$2,278; with 105MB hard disk, \$2,384.

In Short: An excellent contender with above-average electronics and hard-working peripherals, the Tangent 386SX/20 adds an FCC Class B certification to the pile to make it an extremely attractive computer for either home or office.

"The 20 MHz 80386SX is the new entry-level business system of choice, starting right now."

PC Magazine

Best choice of the best choices.

Here's how PC Magazine summed up the Tangent 386TMSX/20 (Tangent's Model 320s):

"The Tangent 386SX packs outstanding video, expandability to 8 MB, and plenty of free slots into a nicely reduced-size case. The price is right too. This PC offers a 105 MB hard disk and Orchid's ProDesigner II Super VGA card for a mere \$2295. Add in clear documentation and on-site service (with Tangent's one-year warranty) and you have a solid winner."

"The Tangent 386SX/20 is the best of the show; it garnered top scores in all of our video tests."

A system with a future. The Tangent 386SX/20 runs all of yesterday's programs. All of today's. And most important, tomorrow's. Because it implements the full Intel 80386 feature set.



Standard Configuration:

- Intel 20 MHz 80386SX CPU **\$2295**
- 2 MB of Memory (to 8 MB)
- 105MB 17ms Quantum Hard Disk
- Orchid ProDesigner IIe SuperVGA Card
- 14" SuperVGA Color Monitor
- Small Footprint Case w/200W Power Supply
- 5.25" or 3.5" High Density Floppy Drive
- Coprocessor Socket
- One Parallel, Two Serial, One Game Port
- 101-key Enhanced Keytronics Keyboard
- One-year Warranty with On-site Service



November 27, 1990
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PC Magazine's windup: "Add an FCC Class B rating and a one-year warranty on parts and labor that includes on-site service into the bargain, and you begin to suspect that the Tangent 386SX/20 is a winner. Consider the price/performance ratio of the computer and that suspicion starts to look like a certainty."

Bill O'Brien, PC Magazine, 11/27/90

Thanks Bill. We couldn't have said it better.

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COVER STORY

16-INCH MONITORS



SUPER VGA MONITORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Dell Graphics Performance Display 16C	PC NEC MultiSync 4D	Nanao FlexScan 9070U	PC Idek MF-5117	Nanao FlexScan 9080I
	\$1,099	\$1,499	\$1,779	\$1,795	\$1,999
PHYSICAL SPECIFICATIONS					
Tilt/swivel base	■	■	■	■	■
Screen size (diagonal, in inches)	16	16	16	17	16
Case dimensions (HWD, in inches)	16 x 15.8 x 17.8	15.4 x 15.2 x 18.7	15.9 x 15.8 x 17.7	16.3 x 15.8 x 16.3	15.9 x 15.8 x 17.7
Weight (pounds)	42	50	42	43	42
Type of connector(s) on monitor	DB-9, BNC-5	DB-15	DB-9, BNC-5	DB-15	DB-9
Adapter cable supplied	■	■	■	■	■
FCC certification class	A	A	B	B	A
COMPATIBILITY					
1,280 x 1,024	□	□	□	□	■
1,024 x 768 (noninterlaced)	■	■	■	■	■
1,024 x 768 (interlaced)	■	■	■	■	■
Super VGA (800 x 600)	■	■	■	■	■
VGA (640 x 480)	■	■	■	■	■
MCGA	■	■	■	■	■
EGA	■	■	■	■	□
CGA	■	■	□	■	□
MDA	□	□	□	■	□
Hercules	□	□	□	■	□
Mac II	□	■	■	■	■
Apple II GS	□	□	□	■	□
OPERATIONAL FEATURES					
Maximum resolution (pixels)	1,280 x 800	1,024 x 768	1,280 x 800	1,024 x 768	1,280 x 1,024
Video bandwidth (MHz)	50 (analog), 30 (digital/TTL)	75 (analog)	50 (analog), 30 (digital/TTL)	65 (analog)	60 (analog)
Vertical scanning frequency range (Hz)	50-80	50-90	50-90	50-90	50-90
Horizontal scanning frequency range (kHz)	20-50	30-57	20-50	21.9-50	30-64
Can maintain image size across resolution modes	■	■	■	■	■
Phosphor persistence	Short	Short	Short	Short	Short
Dot pitch (millimeters)	0.31	0.28	0.28	0.28	0.28
Inputs:					
Analog D-sub connector	9-pin mini	15-pin mini or 15-pin standard	9-pin	15-pin standard	9-pin
Analog BNC coaxial connector (sync on green, composite sync, and separate sync)	■	■	■	■	■
Digital/TTL	■	□	■	■	□
CONTROLS					
Brightness	■ (analog)	■ (analog)	■ (analog)	■ (analog)	■ (analog)
Contrast	■ (analog)	■ (analog)	■ (analog)	■ (analog)	■ (analog)
Color	■ (analog)	□	□	□	□
Horizontal position	■ (analog)	■ (digital)	■ (analog)	■ (analog)	■ (digital)
Vertical position	■ (analog)	■ (digital)	■ (analog)	■ (analog)	■ (digital)
Horizontal size	■ (analog)	■ (digital)	■ (analog)	■ (analog)	■ (digital)
Vertical size	■ (analog)	■ (digital)	■ (analog)	■ (analog)	■ (digital)
Pincushioning	■ (analog)	□	■ (analog)	■ (digital)	■ (digital)
Convergence	■ (analog)	□	■ (analog)	□	■ (analog)
Degaussing	□	■	□	□	□
8/16/64-color switch	■	□	■	■	□
Text color switch	■	□	■	□	■
120/240-volt switch	□	□	□	■	□

PC—Editors' Choice ■—Yes □—No

COVER STORY

16-INCH MONITORS



Mitsubishi Diamond Scan 16L	Mitsubishi HL6615(TK)	IOcomm ThinkSync 17 CM-7126	Philips FC17AS	HP D1188A
\$2,030	\$2,150	\$2,295	\$2,695	\$2,795
■ 16 14 x 15.8 x 17.9 42 BNC-5 □ A	■ 16 14 x 15.8 x 17.9 44 BNC-5 □ A	■ 17 15.3 x 16 x 16.5 50 BNC-5 ■ A	■ 17 15.6 x 16.1 x 18.1 51 BNC-5 □ B	□ 16 14 x 15.8 x 17.9 43 BNC-5 □ A
■ ■ ■ ■ □ □ □ □ ■ ■	■ ■ ■ ■ □ □ □ □ ■ ■	■ ■ ■ ■ ■ □ □ □ ■ ■	■ ■ ■ ■ ■ □ □ □ ■ ■	■ ■ ■ ■ □ □ □ □ ■ ■
1,280 x 1,024 100 (analog)	1,280 x 1,024 110 (analog)	1,280 x 1,024 136 (analog)	1,280 x 1,024 110 (analog)	1,280 x 1,024 100 (analog)
50-90 30-64 ■	50-120 30-64 ■	50-90 30-75 ■	50-140 30-66 □	50-90 30-64 ■
Medium 0.31	Medium 0.31	Medium/short 0.26	Medium/short 0.26	Medium 0.28
None	None	None	None	None
■ □	■ □	■ □	■ □	■ □
■ (analog) ■ (analog) □ ■ (analog) ■ (analog) ■ (analog) ■ (analog)	■ (analog) ■ (analog) □ ■ (analog) ■ (analog) ■ (analog) ■ (analog)	■ (analog) ■ (analog) □ ■ (digital) ■ (digital) ■ (digital) ■ (digital)	■ (analog) ■ (analog) □ ■ (analog) ■ (analog) ■ (analog) ■ (analog)	■ (analog) ■ (analog) □ ■ (analog) ■ (analog) ■ (analog) ■ (analog)
■ (digital) ┌ ■ └ └ ■	■ (digital) ┌ ■ └ └ ■	■ (digital) ┌ ■ └ └ ■	□ ┌ ■ └ └ ■	□ ┌ ■ └ └ ■

done automatically by the GPD-16C. There are no provisions for programming the monitor to work with special user modes.

The GPD-16C is a fine workhorse. Its \$1,099 price is fixed, due to its mail-order distribution channel, and you probably won't find any discounts. But since much of the competition is priced at around twice the cost of the GPD-16C, that should balance out in the end—probably in Dell's favor. Besides, the monitor also comes with Dell's solid reputation for service and user support. (For an additional review of the GPD-16C, see "1024 Monitors," April 10, 1990.)

HEWLETT-PACKARD CO.

HP D1188A

by Kellyn S. Betts



HP D1188A, \$2,795.

Hewlett-Packard Co.'s \$2,795 D1188A is OEMed by Mitsubishi Electronics America and is almost a repackaged version of Mitsubishi's Diamond Scan 16L monitor (also reviewed here). Although very similar in physical appearance, the two monitors are not the same machine; HP has added some of its own touches. These improvements revolve primarily around a focusing enhancement and a readable user manual. Other enhancements on the D1188A include an extra picture control for fine vertical size and access to a voltage selector switch. The question is whether you find these changes worth the D1188A's extra cost.

The 43-pound D1188A is a bit Spartan when it comes to supplying the user with the standard extras most of its competitors provide. Neither an adapter cable nor a tilt/swivel base comes with the monitor—a



PERFORMANCE TESTS: 16- AND 17-INCH SUPER VGA MONITORS

Because the monitors in this roundup performed so similarly, variations in results are not significant. All ten produced acceptable results.

The monitors for this review were tested with the Microvision Super-spot 100. This device calculates spatial relationships and uses a tiny array of photodiodes to measure the light emitted from the screen. Using the VESA-compliant ATI VGAWonder Plus card and working under Microsoft Windows 3.0, we drew 1-pixel-wide lines at the borders of the screen at both VGA (640-by-480) and Super VGA (800-by-600) resolutions.

The **Horizontal Line Width** test measures the width of a 1-pixel-wide horizontal line located 1 inch below the screen's top left-hand corner. Three separate lines (red, green, and blue) are measured, and the resulting average is given in mils (one mil = 0.001 inch).

The **Vertical Line Width** test measures the width of a 1-pixel-wide vertical line 1 inch above the screen's bottom right-hand corner. Three separate lines (red, green, and blue) are measured, and the resulting average is given in mils.

The **Line Width Variance** test is a computed figure that indicates the deviation from an optimal 1:1 ratio between horizontal and vertical line widths. For VGA and Super VGA, which have nominally square pixels, a lower value indicates better pixel sizing.

The **Drift Ratio** test is a computed figure that reports drift (the distance a line moves over a 1-minute period) as a percentage of average line width. A lower number indicates better image stability.

The **Horizontal Pincushioning** test measures the curvature of a horizontal line near the edge of the display. Pincushioning is given in terms of the maximum deviation from a straight horizontal line. A smaller number indicates a straighter horizontal line.

The **Vertical Pincushioning** test measures the curvature of a vertical line near the edge of the display. Pincushioning is given in terms of the maximum deviation from a straight vertical line. A smaller number indicates a straighter vertical line.

SUPER VGA

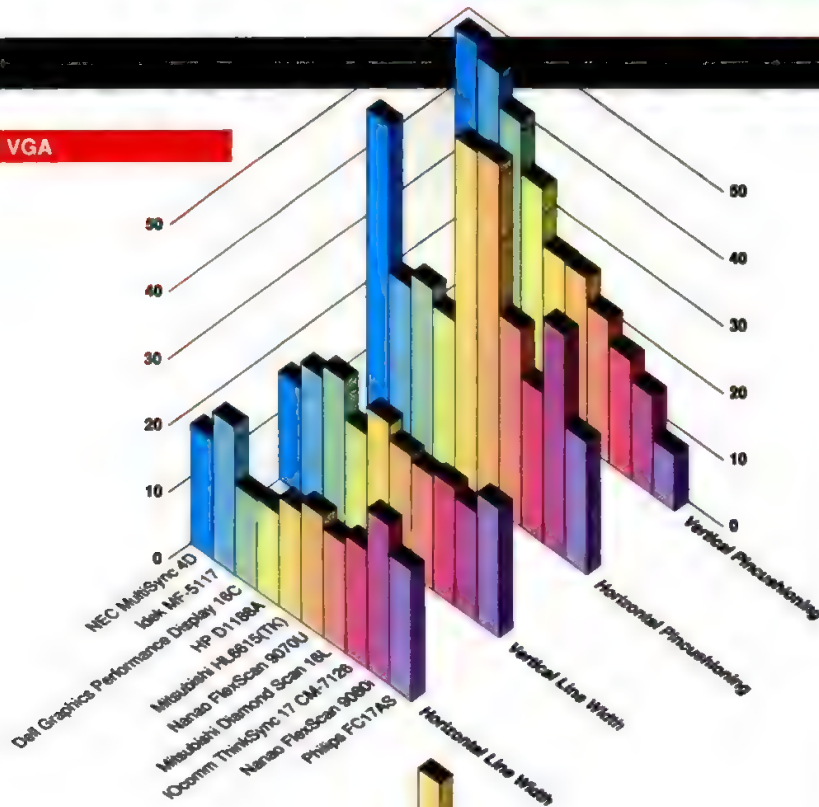
	Horizontal Line Width (mils)	Vertical Line Width (mils)	Line Width Variance (deviation from 1:1 ratio)	Drift Ratio (proportion of line width)	Horizontal Pincushioning (mils)	Vertical Pincushioning (mils)
NEC MultiSync 4D	17.87	16.23	0.10	0.60	45.80	48.50
Idek MF-5117	22.13	20.03	0.10	0.58	23.90	46.50
Dell Graphics Performance Display 16C	13.53	21.93	0.38	0.40	26.00	41.40
HP D1188A	13.80	16.17	0.15	0.77	23.60	33.70
Mitsubishi HL6615(TK)	16.43	20.33	0.19	0.73	51.20	25.40
Nanao FlexScan 9070U	18.23	17.83	0.02	0.61	51.70	25.20
Mitsubishi Diamond Scan 16L	16.50	17.03	0.03	0.43	29.40	21.30
IOComm ThinkSync 17 CM-7126	17.97	17.67	0.02	0.75	22.50	17.90
Nanao FlexScan 9080i	24.07	18.37	0.47	0.68	33.50	14.90
Philips FC17AS	19.73	19.37	0.02	0.84	19.80	8.35

VGA

	Horizontal Line Width (mils)	Vertical Line Width (mils)	Line Width Variance (deviation from 1:1 ratio)	Drift Ratio (proportion of line width)	Horizontal Pincushioning (mils)	Vertical Pincushioning (mils)
NEC MultiSync 4D	17.83	20.10	0.11	0.46	23.20	56.70
Idek MF-5117	20.03	19.33	0.04	0.63	5.23	44.30
Dell Graphics Performance Display 16C	22.53	22.53	0.00	0.41	11.30	46.00
HP D1188A	12.30	17.67	0.30	0.49	37.30	29.50
Mitsubishi HL6615(TK)	16.40	19.80	0.17	0.43	98.30	26.50
Nanao FlexScan 9070U	18.43	22.00	0.16	0.45	44.70	21.90
Mitsubishi Diamond Scan 16L	16.50	19.43	0.15	0.37	13.10	24.60
IOComm ThinkSync 17 CM-7126	19.77	19.57	0.01	0.83	20.50	16.90
Nanao FlexScan 9080i	25.70	19.10	0.35	0.55	9.20	6.00
Philips FC17AS	20.20	19.80	0.02	0.66	13.50	8.60

COVER STORY 16-INCH MONITORS

SUPER VGA



Our test results indicate that for the most part, the ten Super VGA monitors perform so similarly that you're unlikely to see any differences with the naked eye.

On the Horizontal and Vertical Line Width tests, most of the monitors averaged line widths between 15 and 20 mils. They also displayed minimal line width variation. The Nanao FlexScan 9080i came in last, displaying a more than 30 percent variation from a perfect 1:1 ratio in both VGA and Super VGA resolution; the HP D1188A showed the next-highest variance in VGA mode, and the Dell Graphics Performance Display 16C in Super VGA mode. Since the aspect ratios of VGA and Super VGA displays produce nominally square pixels, vertical and horizontal lines should display roughly the same thicknesses.

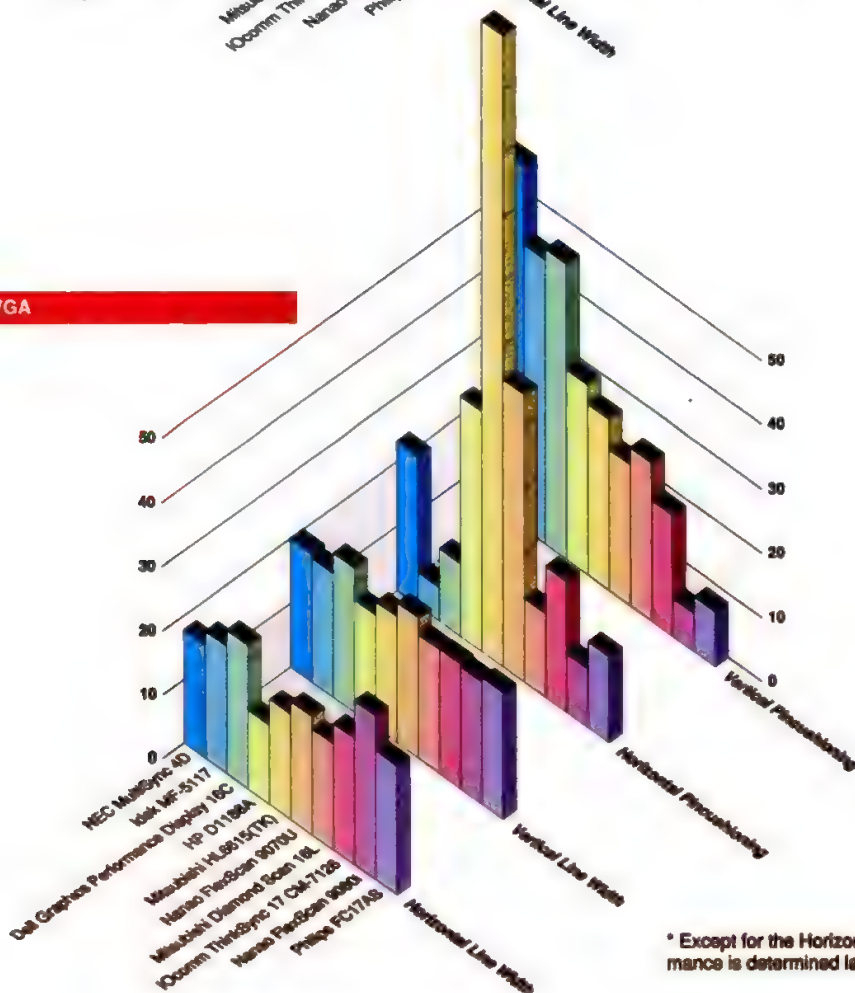
The Drift Ratio figures also showed relatively stable images. Most of the monitors produced a less than 70 percent drift; even the worst drift shown here is not visible to most users. Values of 1.00 or above (a line width or larger) would make the entire image appear to move back and forth.

The tests that showed the most significant variations were the pincushioning measurements. A few monitors displayed lines that were bent an entire line width or more, producing a noticeably curved line.

The worst pincushioning performer overall was the NEC MultiSync 4D; its results were the highest for vertical pincushioning, the third-highest for horizontal pincushioning in Super VGA, and the fourth-highest for horizontal pincushioning in VGA. The Mitsubishi HL6615(TK) turned in the worst horizontal pincushioning numbers in VGA, and was accompanied in Super VGA by the Nanao FlexScan 9070U. In Super VGA resolution, the Idek MF-5117 produced vertical pincushioning results similar to the NEC MultiSync 4D.

You should, however, remember that monitor performance can vary from unit to unit, and measurements made on our test units might not be exactly duplicated by other units of the same model. These measurements should be taken to characterize the attributes of one display relative to another, rather than as an index of absolute monitor performance.

VGA



Performance Scores
(Shorter bars represent better performance*)

* Except for the Horizontal and Vertical Line Width tests, where good performance is determined largely by user preference for thin or thicker lines.

HP D1188A

Hewlett-Packard Co., 19310 Pruneridge Ave.,
Cupertino, CA 95014; 800-752-0900.

List Price: \$2,795; tilt/swivel base, \$150;
cable, \$99.

Requires: VGA or Super VGA graphics
adapter.

Diagonal Screen Size: 16 in.

In Short: The main difference between this
pricey monitor and the Mitsubishi Diamond
Scan 16L is some proprietary screen-focusing
technology. The HP D1188A, with a 0.31-mm.
dot pitch, supports resolutions up to 1,280 by
1,024, has a large number of user-adjustable
stored settings, and even includes a well-
written manual.

CIRCLE 848 ON READER SERVICE CARD

little surprising when you consider the
unit's cost. The tilt/swivel base will cost
you another \$150 and a BNC connector an
additional \$99.

DYNAMIC BEAM FOCUSING SYSTEM

HP's primary engineering enhancement
to the 16-inch analog-only display is what
the company calls a "dynamic beam fo-
cusing system." This is supposed to elimi-
nate any warping or fuzziness at the edges
of the screen—an area notorious for such
problems—and make the image as fo-
cused here as at the center. The review
unit we received had no problems ex-
panding its image to fill all four corners of
the viewing area. However, though it
generated a pleasing, well-centered im-
age, this feature also caused heavy hori-
zontal pincushioning in VGA mode and
vertical pincushioning in Super VGA. This
marked bowing effect was visible not
only to our Microvision testing machine,
but also to the naked eye. The monitor's
position controls weren't much help.

This proprietary focusing system also
didn't seem to make the horizontal or
vertical lines in the screen edges any
brighter than those of its Mitsubishi rela-
tive. In some cases, they were actually a
bit dimmer.

CONTROL PROS AND CONS

Like the Mitsubishi monitor, the HP
D1188A's front-mounted picture controls
work similarly to the "menu select"
modes found on many dot matrix print-
ers—except they provide even less feed-
back. You have to throw a DIP switch
hidden under a panel at the machine's
bottom left corner to get into picture
control mode, then use a screwdriver to
flip the picture control switch to the new

16-INCH MONITORS

parameter. You use the rest of the front-
mounted controls to first make your
changes, then save them in the monitor's
memory.

The good thing about the monitor's
controls—which include degaussing
switches—is that once they're set, you
can leave them alone. They allow the
monitor to store a number of size and
positioning settings. The HP D1188A
comes with three factory-programmed
settings for VGA, one for the Macintosh
II, and settings for other resolutions up to
the monitor's maximum of 1,280 by 1,024.
The picture controls let you adjust these
preprogrammed settings (optimal size and
positioning, for instance) according to
your personal tastes.

The monitor can save up to eighteen
additional settings, which can even be

The good thing about
the HP D1188A's
controls is that
once they're set,
you can leave them
alone.

used to vary the image for different appli-
cations within one resolution. Hewlett-
Packard's manual describes the controls'
use thoroughly.

A BENEVOLENT MANUAL

The manual is a major improvement over
the one offered by Mitsubishi, and could
make it much easier for the less experi-
mental or experienced user to take full
advantage of the D1188A's many fea-
tures. It provides many detailed illustra-
tions and mentions helpful niceties, such
as the fact that the monitor should not be
plugged into a computer-mounted power
outlet.

The D1188A is a solid monitor, if a
little pricey and bereft of much-needed
extras such as the tilt/swivel base and
BNC cable. But it does come with Hewl-
ett-Packard's renowned service and sup-
port staff and a warranty for one year's
worth of parts and labor.

IDEK NORTH AMERICA**Idek MF-5117**

by John R. Quain



Idek MF-5117, \$1,795.

A successful crossover artist, the 17-inch
Idek MF-5117 will score hits on the digi-
tal and analog charts. With a suggested list
price of \$1,795, the ability to handle digi-
tal or analog signals, a remarkably bright
picture, and enough inputs and scanning
frequencies to handle most graphics cards,
users who require flexibility and conveni-
ence are sure to sing its praises.

The MF-5117's seamless multiscan-
ning offers a top noninterlaced resolution
of 1,024 by 768. It will also accommodate
resolutions well below that, including
EGA, MDA, and Hercules graphics cards.
(The MF-5117 can also manage Macin-
tosh II and Apple II GS graphics.) On the
back of the monitor, you'll find digital 9-
pin TTL, 15-pin analog, and BNC-5 in-
puts. The cable that comes with the moni-
tor has a mini 15-pin configuration. If you
need cables for a Macintosh II or BNC
configuration, Idek can supply them
(prices range from \$40 to \$65).

NICE IMAGE WITH MINOR MINUSES

Boasting short-persistence phosphors and
a dot pitch of 0.28 mm., this Idek monitor
can provide some delicate, fine-grained
images. Moreover, line-width measure-
ments were remarkably consistent in both
VGA and Super VGA modes. When we
squinted closely at the crosshair pattern,
however, we witnessed a slight S-shaped
line deviation about 0.25 inches down
from the top of the screen in Super VGA
mode. (We should note, however, that this
effect was not confined to the Idek moni-
tor.) The S effect manifested itself under
graphics presentation packages such as



“There is very
little more you
can ask for from
a computer.”

— *PC Magazine*
January 15, 1991



How about:

☑ Editor's Choice ☑ 33MHz '386 ☑ 128K SRAM

Cache ☑ Up to 32MB Motherboard Memory

☑ Eight Bay Vertical Case ☑ 250 Watt TurboCool

Power Supply ☑ Twin Cooling Fans ☑ DOS 4.01

& Windows & Mouse ☑ FCC Class B ☑ 24 Hour

a Day Toll Free Sales and Technical Support

"The combination is as close to unbeatable as you can get."

— PC Magazine

SYSTEMS

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Because at ZEOS, we not only build our own systems, we design them from the ground up too. Unlike most of the others, ZEOS maintains its own chip level Research and Development Labs plus our own board level manufacturing facility. All right here in St. Paul, Minnesota, USA.

You can buy with confidence too because ZEOS is a strong and rapidly growing public company (NASDAQ Symbol: ZEOS). As a matter of fact, according to *INC. Magazine*, ZEOS is America's 19th fastest growing public company! And, our professional

Systems Consultants and expert Technical Support staff serve tens of thousands of customers World Wide, Twenty Four Hours a Day.

Performance. Quality. Price and Support. And all of it backed by the ZEOS Customer Satisfaction Package which includes our 30 Day Absolute Satisfaction Money Back Guarantee, One Full Year Limited Warranty and our Express Parts Replacement Policy. You're going to be very satisfied. We don't just say it. *We Guarantee it!*

ORDER YOUR NEW ZEOS '386 TODAY!

As *PC Magazine* recently said "It's difficult to be more eloquent about the ZEOS '386-33 than it already is about itself." They went on to say ZEOS shows "you needn't be among the most expensive to be the best." We couldn't have said it better ourselves.

Why not pick up the phone and give us a call right now. Your own expert Systems Consultant is waiting here now to help you tailor your new ZEOS '386 to your specific needs. Buying your ZEOS '386 is perhaps the best purchase decision you'll ever make! After all, your satisfaction is absolutely *Guaranteed*.

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As *PC Magazine* said, ZEOS offers "more options than even the most configuration hungry hound could possibly need." Because every ZEOS system is custom built you may choose from a huge selection of hard drives, video packages and many other options. On-site service is available too. Call 800-423-5891 for details.

ZEOS '386 SYSTEMS— A FEW EXPERT OPINIONS:

PC Magazine, "Out of 104 machines from 58 companies... For Overall Excellence we selected ZEOS International..."

InfoWorld, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent."

Government Computer News, "Arguably the fastest MS-DOS and OS/2 micro in the world."

PC Resource, "ZEOS ... provides quality comparable with IBM or Compaq and does so for about 70% of the price."

PC Magazine, Editor's Choice, "The ZEOS blows away every other computer... a smart choice."

**ZEOS '386 SYSTEMS.
A SMART CHOICE
INDEED!**



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Upgrade from 85MB to 124MB for only \$195 or go up to 200MB for only \$525. Packages with our 124MB standard go to 200MB for only \$330!

Circle 745 on Reader Service Card.

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- ZEOS/RS 101 key SpaceSaver Keyboard.
- ZEOS I/O Card with Two High Speed Serial plus Parallel and Game ports.
- 1-32, 6-16 & 1-8 bit expansion slots.
- Rugged ZEOS 5-bay desktop case with 250 Watt TurboCool® power supply for increased component life and system expandability, an important extra at no additional cost.
- Microsoft® DOS 4.01 with Disk Cache Software *plus* Microsoft Windows™ 3.0 and mouse!
- Full ZEOS Satisfaction Package.

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ZEOS '386 Systems.

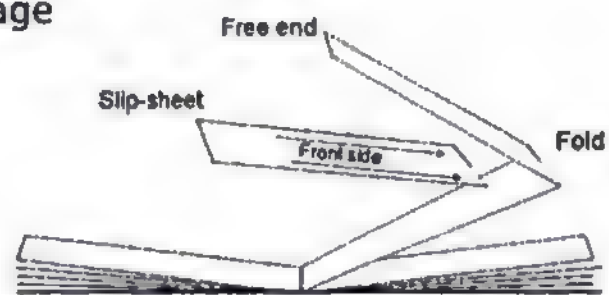
~~Five~~ ~~Four~~ Times Editor's Choice

“Deserving of this award is the ZEOS 386-33 with its superior combination of performance, expandability, and price.”

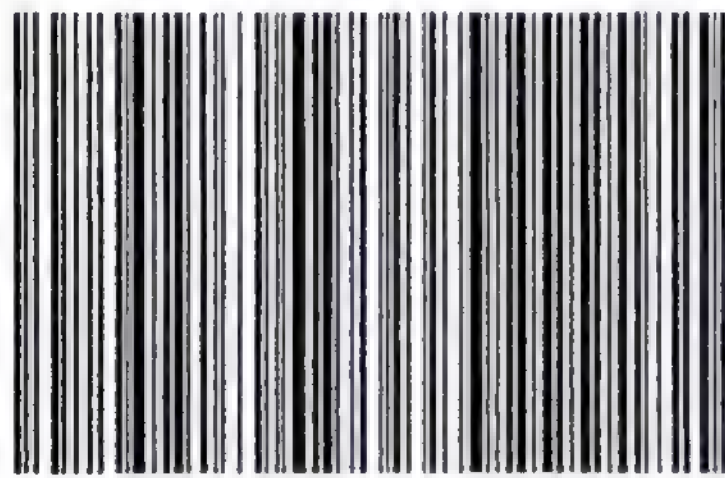
— *PC Magazine, On Why the ZEOS 386-33 Wins Editor's Choice.*

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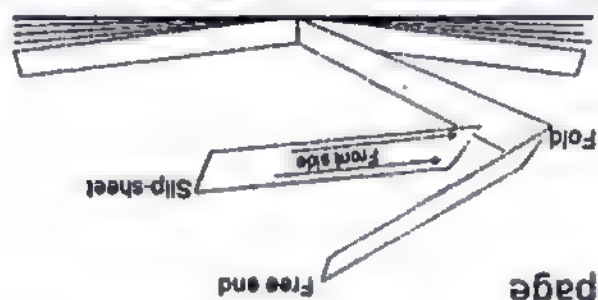
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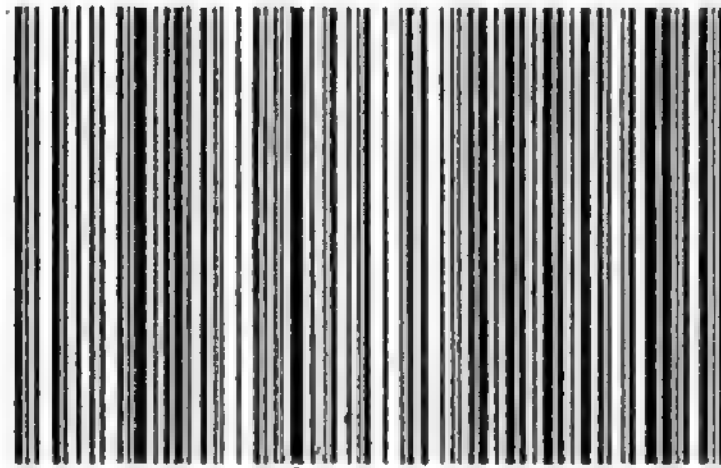
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Back

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Take it from the experts. ZEOS builds the best '386 systems! "Quality comparable with IBM or Compaq... Excellent Value... Blows away every other computer... ZEOS is top drawer... Unbeatable... Top Honors... A smart choice!"

The industry experts love ZEOS systems.

And you will too. Why?

Because ZEOS really does build the very best

'386 systems you can buy. In naming the ZEOS '386-33 *Editor's Choice*, *PC Magazine* said ZEOS shows "that you needn't be among the most expensive to be the best." But what does that mean to you?

It means that when you purchase your new ZEOS '386 you will receive more Performance, superior Quality, and better Support than you can get anywhere else. Take performance for instance.

CACHE MEMORY MEANS PERFORMANCE!

That's why each and every ZEOS '386DX system has a minimum of 64K SRAM Cache standard; *our 33MHz screamers come standard with a 128K*

Cache. Having an on-board memory cache is important in realizing the full potential of any '386 processor. That's why only low end '386DX systems are sold without a Cache. That's why ZEOS gives you a Cache, and all the extra performance that comes with it!

And it's not only the Cache that's fast, so is everything else. In choosing the ZEOS '386-33 as *Editor's Choice*, *PC Magazine* noted "ZEOS International designed this machine for speed—and came up with a system that topped four of our benchmark tests and excelled on the remaining ones." Designed for speed. Absolutely.

Speaking of speed. Standard in your new ZEOS '386 will be one of our *incredibly fast* 85MB or 124MB IDE hard drives. These babies were designed for the '386 and they come packing all the speed you'll need. Like *PC Magazine* said, ZEOS designs for speed. And for Quality Too.

ZEOS QUALITY. SECOND TO NONE.

When you buy your new ZEOS system you are buying *absolute Quality*. As an example, every ZEOS '386DX system comes with a 250 Watt TurboCool® power supply. They cost more, they're better too. Much Better. We invest more in our power supplies and cooling systems to help assure you years of trouble free operation. Even the small details can make the difference.

Like our floppy drives. We use only genuine Teac®. They are the best money can buy. The same is true of *all* the components of your system. Only *the very best* are used. Everything is top notch. Top quality. Top Value.

You'll especially like the value you find in our money saving ZEOS system packages. And when you opt for any package with 4 Megs of memory, we also include the new version of Microsoft®

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10 Good Reasons To Buy From ZEOS®

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but four times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

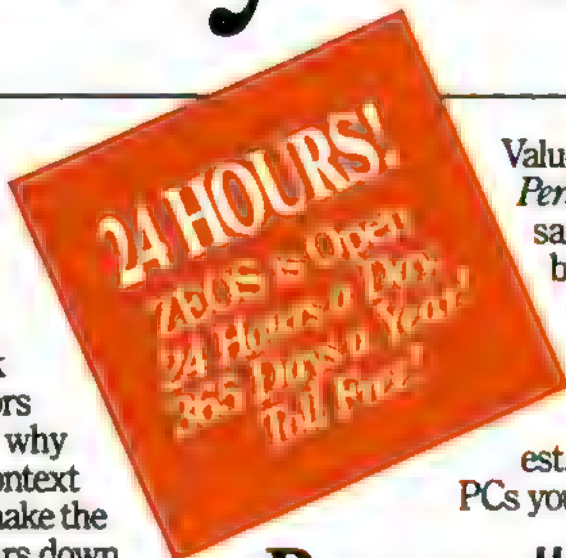
Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent."



Value: Excellent."

Personal Computing said, "ZEOS... is the best value we've come across... its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

Reason #6

24 Hour Toll Free Technical and Sales Support.

At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

Experience.

Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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Reason #10

You're Going to be Very Satisfied.

When it comes right down to it, you're going to be very satisfied with your new ZEOS system. Our goal is your complete satisfaction. And that's our commitment to you. To quality. To performance. To reliability and support. To *Value*. We don't just say it, *we Guarantee it!*

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Please complete all appropriate sections, *providing at least two years residence and employment history*. If you are self-employed, please be sure to complete "Self Employment Information" section. **THIS IS NOT A CREDIT AGREEMENT!** One will be sent to you upon authorization of an account. (This Form Must Be Signed To Process Your Order.) All Financed Purchases Are Subject To Credit Approval. **If You Have Any Credit Questions, Please Call 800-421-8942 For Assistance. Thank You!**

A married person may apply for individual credit. I am applying for (please check appropriate box):

- ☐ **JOINT CREDIT** with another person.
Complete entire application.
- ☐ **INDIVIDUAL CREDIT** but rely on income or assets of another person as a basis for repaying the credit requested. Complete entire application.
- ☐ **INDIVIDUAL CREDIT.**
Do not complete Section C.**

**If you are a married Wisconsin applicant, you must provide your spouse's information as indicated, even though your spouse may not be signing the contract.

NOTICE TO WISCONSIN APPLICANTS: YOU MUST DISCLOSE YOUR MARITAL STATUS:

☐ married ☐ unmarried ☐ legally separated

A. YOUR PERSONAL INFORMATION

Name _____

Home Phone (_____) _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Since? (Mo./Yr.) _____ ☐ Buy ☐ Rent ☐ Other _____

Previous Address _____

City _____ State _____ Zip _____

Employer _____ Since? (Mo./Yr.) _____

Monthly Gross Salary \$ _____ Daytime Bus. Phone (_____) _____

Previous Employer _____ From - To _____

Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as basis for repaying this obligation.

Additional Monthly Income \$ _____ Source: _____

Name & Address of Nearest Relative Not Living With You _____

Relationship _____

B. CREDIT INFORMATION

PLEASE TELL US IF YOU HAVE: Checking Account ☐ Yes ☐ No Savings Account ☐ Yes ☐ No

	Y/N	How Many?		Y/N	How Many?
Bank Loan	_____	_____	Dept. Store Charge Card	_____	_____
VISA	_____	_____	Credit Union Account	_____	_____
MasterCard	_____	_____	Other Major Charge Cards	_____	_____
Finance Company Loan	_____	_____			

C. JOINT APPLICANT INFORMATION

Joint Applicant's Name _____

Soc. Sec. No. _____ Date of Birth ____/____/____

Address _____ Apt. _____

City _____ State _____ Zip _____

Home Phone (_____) _____ Date of Residence (Mo./Yr.) _____

Joint Applicant's Employer _____ Since? (Mo./Yr.) _____

Bus. Phone (_____) _____ Monthly Gross Salary \$ _____

CUSTOMER AUTHORIZATION

I authorize ZEOS International, Ltd. or its assignees to investigate credit records and to report my performance hereunder to credit agencies. I hereby certify that the following information is furnished to you for the purpose of obtaining credit and is true and correct to the best of my knowledge and belief.

Applicant's Signature _____

Date _____

Joint Applicant's Signature _____

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Microsoft Windows 3.0, where the ruler-straight border experienced a minor vertical-edge dent near the uppermost right-hand corner of the screen. How much this may matter to you—and to what extent this applies to all MF-5117s as opposed to only this one unit—is difficult to say.

On the other hand, with a VGA field of capital M's on a white screen, the blacks stayed black and the whites stayed white. There was no visible gray shading, which can indicate poor transient response, between the uprights of the letter. Switching to Super VGA resolution, transient response suffered ever so slightly with a nearly indiscernible amount of shading between the legs of the M's near the edges of the screen. Convergence, as reflected in the benchmark tests, was better than average for a screen this size.

GREAT COLOR REPRODUCTION AND CONTROLS

The set continued to excel when it came to color reproduction. The MF-5117 was one of the best in this roundup at faithfully displaying subtle shadings between colors without sacrificing brightness or saturation. There was no significant jitter or drift, with measurements falling roughly in the middle of the Super VGA pack.

We had to adjust the horizontal size and position when switching between VGA and Super VGA. But this is not a problem. All the controls (power, brightness, contrast, horizontal position, horizontal size, vertical position, and vertical size) are on the front and marked with recognizable icons. Furthermore, there are center-position detents for all the settings—save contrast—in case you monkey with it too much. Also conveniently

placed just under the front lip of the chassis is a switch for making 8-, 16-, 16/64-, or 64-color mode changes.

A subsidiary of longtime Japanese monitor-maker Iiyama, Idek offers a one-year parts-and-labor warranty. The MF-5117 is also certified Class B by the FCC. Although not capable of ultra high-end resolutions, this machine won't disappoint mainstream users.

IOCOMM INTERNATIONAL TECHNOLOGY

IOcomm ThinkSync 17 CM-7126

by John R. Qualn



IOcomm ThinkSync 17 CM-7126, \$2,295.

If you don't want to think about video bandwidths and graphics compatibility, the \$2,295 ThinkSync 17 CM-7126 from IOcomm will do most of it for you. This monitor will automatically respond to signals from MCGA cards up to high-end 1,280-by-1,024 graphics adapters.

The ThinkSync 17 is constructed around a Toshiba FST tube with a fine dot pitch of 0.26 mm. and medium- to short-persistence phosphors. However, its horizontal scanning frequency range of 30 to 75 kHz won't let it reach back to EGA or Hercules graphics adapters. Also, there's no digital input, only the five-wire BNC arrangement. It does ship with a tilt/swivel base, though, and the supplied power and BNC cables are long enough (6 feet) to reach hidden CPUs.

CONTROLS THAT REMEMBER

If you decide you don't like the way the images appear, the picture controls on the

side of the ThinkSync 17 include two rotating knobs for brightness and contrast. Once they're set, your preferences can be locked in by depressing the knobs. We found the controls allowed us to achieve desired brightness and contrast levels even under fluorescent office lights. The brightness control, however, had an annoying habit of jamming in the case.

Directly above these controls are two push buttons and a dial to select screen adjustment parameters: horizontal sizing, horizontal positioning, vertical sizing, and vertical positioning. Also helpful were two settings to adjust for pincushion and barrel distortion (an effect best described as the inverse of pincushioning). The push buttons enable you to make changes in small increments, which will be appreciated by those with a keen sense of proportion.

The ThinkSync 17 comes with at least one factory-preset graphics mode stored in memory with up to 13 additional user-adjustable settings available. Simply turn the dial back to the top position to store preferred settings. If you discover that someone has been making psychedelic portraits with your monitor, there's a reset switch to return the display to the factory presets.

A LITTLE JITTER, BUT EXCELLENT CONVERGENCE

The ThinkSync 17's FST Toshiba CRT produces sharp, accurate images. Line-width ratios for this monitor were very consistent—near perfect, in fact. There are always tradeoffs, however, when it comes to monitor design, especially in terms of sharpness. Wider lines, for example, mean softer, and to some eyes, better or more-pleasing images. The more



FACT FILE

EDITORS' CHOICE

Idek MF-5117

Idek North America, 850 Louis Dr., #120, Warminster, PA 18974; 215-957-6543.

List Price: \$1,795 (tilt/swivel base and cable included).

Requires: EGA, MCGA, VGA, Super VGA, or 8514/A graphics adapter.

Diagonal Screen Size: 17 in.

In Short: A reasonably priced monitor with easy adjustments, the Idek MF-5117 delivered one of the brightest and sharpest pictures in this roundup. Although it can't reach 1,280-by-1,024 resolution, its great color handling and fine 0.28-mm. dot pitch set it apart from the crowd.

CIRCLE 148 ON READER SERVICE CARD



FACT FILE

IOcomm ThinkSync 17 CM-7126

IOcomm International Technology, 12700 Yukon Ave., Hawthorne, CA 90250; 213-644-6100.

List Price: \$2,295 (tilt/swivel base and cable included).

Requires: MCGA, VGA, Super VGA, 8514/A, or 1,280-by-1,024 graphics adapter.

Diagonal Screen Size: 17 in.

In Short: A brainy machine, the multiscanning ThinkSync 17 will autosize from 1,280 by 1,024 down to MCGA; it has a dot pitch of 0.26 mm. and projects a sharp picture. Its price and some minor image flaws may make you hesitate before deciding to buy it.

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CIRCLE 522 ON READER SERVICE CARD

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razor-sharp the edges, the more noticeable any inconsistencies, and the ThinkSync 17 had its share of them. Under the emotionless eye of the Microvision equipment, the IComm monitor exhibited some of the poorer time variance numbers, meaning that its fine lines tended to waver and cause jitter near the edge of the screen.

In GUI-generated graphs and charts, this was undetectable. Running *Microsoft Windows 3.0* in Super VGA, however, revealed vertical borders that looked more like rope than the thin steel bars that should have prevailed. This was not noticeable in VGA mode, and in Super VGA mode the distortion was localized: There was no effect on objects anywhere else on the screen.

Compensating somewhat for this

The inexpensive, attractive Mitsubishi HL6615(TK), with its high resolution and wider bandwidth, tends to address the needs of the high-end user.

anomaly was excellent convergence. In creating solid, 1-pixel-wide lines, there was none of the blurring that can occur at the edges of the screen (where the CRT's electron guns have the most trouble focusing). The capacity of the monitor to lay down sharp black-on-white images was also good, indicating commendable transient response. Color saturation almost seemed to have been too good; some of the subtler color shades suffered from a touch of oversaturation.

From corner to corner, the ThinkSync 17 is a capable monitor. Even though its odd roping on the edges of some graphics may seem disturbing, the overall picture was still very solid. We found the owner's manual a bit laconic, but adequate for most needs. If this \$2,295 set's 17-inch dimensions still appeal to you, look for dealer discounts.

POWER STORY 15-INCH MONITORS

**MITSUBISHI ELECTRONICS
AMERICA INC.**

Mitsubishi Diamond Scan 16L Mitsubishi HL6615(TK)

by Kellyn S. Betts



Mitsubishi Diamond Scan 16L (left), \$2,030, and Mitsubishi HL6615(TK) (right), \$2,150.

The differences between Mitsubishi's \$2,030 Diamond Scan 16L and its \$2,150 HL6615(TK) are far more subtle than their dissimilar names suggest. The Diamond Scan continues that popular product line's tradition of solid syncing capabilities, while the high-resolution HL6615(TK), with its wider bandwidth, tends to address the needs of the high-end user. (For more information on Diamond Scan monitors, see "Super VGA: Monitors with More," May 15, 1990.)

Both monitors are inexpensive, attractive, analog-only machines capable of generating resolutions from 640-by-480 (VGA) to 1,280 by 1,024. The Diamond Scan will place 42 extra pounds on your desk, while its sibling is two pounds heavier. Both monitors come with tilt/swivel bases, but neither includes an adapter cable. The machines have FCC Class A certification.

PROGRAMMABLE FUNCTIONS AND POOR MANUALS

When you plug one of these well-ventilated monitors into a video card, they automatically compare the frequencies they sense with preprogrammed timings at intervals of 3 kHz and use the closest

one. They can also be programmed to record other timings (frequencies explicitly for VGA and Macintosh II signals are included) if an image's preprogrammed size and position prove inadequate. Once recorded, timings are saved in the monitor's digital memory to provide the desired image size when that resolution is displayed. Additionally, settings for different image sizes within one resolution (one each for the Super VGA versions of *Microsoft Windows* and *AutoCAD*, for example) can be saved.

The monitors can be programmed through a slightly involved method proprietary to Mitsubishi products. You need to run the monitor in the given mode, activate a DIP switch setting to begin programming mode, set the desired specifications through the monitors' regular image controls, enter the setting via the Entry button, and finally, switch the DIP switch back to normal operations mode. (For more information on these programming features, see both "1024 Monitors," April 10, 1990, and "Super VGA: Monitors with More," May 15, 1990.) By changing the other front-panel controls' function, you can make infinite adjustments—within the monitor's range of capabilities—of any image's horizontal phase, size, or position or its vertical phase and position. The HL6615(TK) has an additional button for fine vertical size.

These programming functions can prove useful, as different vendors' video cards sometimes produce different signals for a given mode. Unfortunately, Mitsubishi's poorly translated manuals describes them in a terse fashion more



FACT FILE

Mitsubishi Diamond Scan 16L Mitsubishi HL6615(TK)

Mitsubishi Electronics America Inc., 991 Knox Dr., Torrance, CA 90502; 800-556-1234 ext. 54 (outside Calif.), 213-217-5732.
List Price: Diamond Scan 16L, \$2,030; HL6615(TK), \$2,150 (tilt/swivel base included).

Requires: VGA or Super VGA graphics adapter.

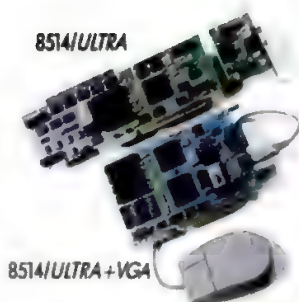
Diagonal Screen Size: 16 in.

In Short: These reasonably priced high-end monitors provide improved automatic sensing because of their extensive programmability. Each produces a maximum resolution of 1,280 by 1,024 at a 0.31-mm. dot pitch. A few image problems, a skimpy manual, and the substantial prices may give you pause.

CIRCLE 848 ON READER SERVICE CARD

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CIRCLE 540 ON READER SERVICE CARD

The Nanao 9070U's
VGA performance
was flawless, and
positions for all of the
video adjustments
were ideal.

16-INCH MONITORS

probably want the HL6615(TK). If you don't need such abilities, you'll be hard-pressed to tell the difference between the two models.

NANAO USA CORP.

Nanao FlexScan 9070U Nanao FlexScan 9080i

by Bill O'Brien

appropriate for engineers than end users.

Surprisingly, one thing the manuals don't mention is the major difference between the two products: The HL6615(TK)'s video bandwidth is, at 110 MHz, higher than that of the 100-MHz Diamond Scan. The higher bandwidth can be advantageous in displaying complex and detailed CAD renderings, according to Mitsubishi.

Another difference—a minor one—is in the way each monitor differentiates between composite external sync signals and signals with separate horizontal and vertical sync. The Diamond Scan 16L has a INT/EXT switch not found on the HL6615(TK). Both monitors can be daisy-chained using split BNC cables, thanks to switches in the rear that allow the input connectors to terminate or pass along signals—the latter with the aid of separately purchased T-connectors.

PERFORMANCE DIFFERENCES

The Diamond Scan generally scored better on our Microvision performance tests than did its sibling. The HL6615(TK) we tested had swim problems, and exhibited distinctive roping along the edges of Super VGA images. Its images appeared somewhat bowed; tests pointed out some major horizontal pincushioning problems. One unusual problem with the HL6615(TK) revolved around color distortion and the thinning of a 1-pixel-wide line in VGA mode. This didn't seem to show up on the machine tests, but was clearly visible to the naked eye.

Nevertheless, if the strange programming mode of these machines appeals to you and you don't mind the garbled manuals, then both the Diamond Scan 16L and HL6615(TK) are dependable choices. If you plan to team your monitor with a high-resolution adapter, you'll



Nanao FlexScan 9070U (left), \$1,779, and Nanao FlexScan 9080i (right), \$1,999.

Nanao markets a plethora of monitors, each with its own designation and separate set of features; like steps on a stairway, each model offers higher video ability. You'll find the FlexScan 9070U and FlexScan 9080i near the top. They're almost the same monitor, but not quite. In fact, the differences in their features are hardly emphasized by the \$220 that separates the 9070U's \$1,779 price tag from that of the \$1,999 9080i.

Both monitors share the same gray case and tilt/swivel stand, and each pegs the scale at 42 pounds. A short-phosphor tube lights the images through a 0.28-mm. dot pitch mask officially termed a dark-face, nonglare CRT. EGA, VGA, Super VGA, and 1,024-by-768 resolutions are no problem for either monitor, as both are rated at 1,280 by 800. Although both are multiscanning, frequencies below EGA are usually not tolerated by either of these peripherals. Double-scan CGA images, which are produced by a VGA card, are acceptable.

The FlexScan 9080i has FCC Class A certification, while the 9070U is certified

Class B. The final common trait between the two monitors is an 84-inch removable power cable and a front-mounted on/off switch.

THE 9070U

The FlexScan 9070U is a combination digital and analog monitor with a 20- to 50-kHz horizontal and 50- to 80-Hz vertical frequency range. Both 9-pin D-shell and BNC connectors are provided for either digital or analog inputs. Separate sync, sync on green, and composite sync are acceptable formats.

The monitor is alive with a multitude of controls. At the rear, there's a switch for toggling between TTL and analog input types, and a color-mode switch allows you to configure the monitor for digital signals. A separate push button identifies the input as VGA or "other" signals—technically, it adjusts the vertical display size for the current viewing mode. The rear panel also holds the means to make focus, convergence, and pincushioning adjustments.

Thumbwheels with center-position detents are front-mounted below the bezel; they allow you to control the image's brightness, contrast, vertical, and horizontal size and position. You'll also find a three-position text-color selector (for green, black-and-white, and amber), as well as a two-position switch that lets you toggle between BNC and D-sub connector inputs (a handy feature if you have two video sources connected to the same monitor).

The 9070U's VGA performance was flawless. Center detent positions for all of



FACT FILE

Nanao FlexScan 9070U

Nanao FlexScan 9080i

Nanao USA Corp., 23535 Telo Ave., Torrance, CA 90505; 213-325-5202.

List Price: FlexScan 9070U, \$1,779;

FlexScan 9080i, \$1,999 (tilt/swivel base and cable included).

Requires: EGA (for the 9080i), VGA, Super VGA, or 1,024-by-768 graphics adapter. Diagonal Screen Size: 16 in.

In Short: Both monitors produce excellent images—with few if any problems—at maximum resolutions around 1,280 by 800 at a 0.28-mm. dot pitch. The microprocessor-controlled sizing and positioning of the analog FlexScan 9080i make it just a little better than its sibling. Either machine is well worth its price.

CIRCLE 549 ON READER SERVICE CARD

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the video adjustments were ideal, and the color response was excellent. Super VGA mode still showed the same excellent output, but we had to adjust the horizontal in order to center the graphic *Microsoft Windows* images. Switching back to text meant another horizontal adjustment.

THE 9080i

The 9080i is restricted to analog operation, since its multiscanning capabilities are between 30 and 64 kHz horizontally and 50 to 90 Hz vertically. While it shares the same rear-panel BNC and D-sub connectors, without digital input it eschews all the 9070U's rear controls except for focus and convergence.

Under the front bezel you'll find the same brightness, contrast, text color, and BNC/D-sub selector knobs and switches. All other controls are relegated to intelligent microprocessor control (the reason for the 9080's "i" designation). Vertical and horizontal size and position, as well as pincushioning, are controlled via a single thumbwheel and two momentary switches labeled Select and Enter.

Pressing Select allows you to choose from among the adjustable options, which are displayed on an LED. The thumbwheel lets you adjustment the image, and when you're done you move on to the next feature until all are correct for the video source you're using. Two possibilities then exist: You can press the Enter button and store the adjustments in the monitor's memory (27 different adjustments, including the factory default, can be stored), or, if the video source is temporary, the adjustments will automatically be erased from volatile user memory when the monitor is shut off.

The 9080i exhibited the same quality video as the 9070U under the VGA version of *Windows*. Position and size adjustments weren't necessary, but pincushioning adjustments were needed to cure a slight vertical bowing. Surprisingly, no changes whatsoever were needed under Super VGA resolution in either text or graphics modes.

Either of Nanao's monitors would make excellent additions to a graphics-dependent computer system, but if you're not in need of digital capability, the 9080i is probably the better choice. The intelligence built into this monitor eliminates all of the arm stretching and wheel turning so often associated with video mode changes. This reason alone makes it worth the \$150 price difference.

NEC TECHNOLOGIES INC. NEC MultiSync 4D

by Bruce Brown



NEC MultiSync 4D, \$1,499.

NEC Technologies has been a standard for multisynchronous monitors since the middle 1980s. Its entry into the 16-inch class, the NEC MultiSync 4D, combines an extremely wide input signal range with excellent price and solid performance.

The 44-pound MultiSync 4D, which won an Editors' Choice award last year ("1024 Monitors," April 10, 1990), lists for \$1,499, but is heavily discounted by dealers and often available for under \$900. The analog-signal MultiSync 4D comes with a detachable tilt/swivel base and a single 15-to-mini-15-pin interface cable.

STRONG COMPATIBILITY

Compatibility with a variety of current high-powered display adapters is the 4D's strong point. The multisynchronous unit automatically determines display mode based on input frequencies; it can work with MCGA, VGA, Super VGA, as well as both interlaced and noninterlaced 1,024 by 768 resolutions. The 4D also works with the video outputs from Macintosh II computers. Furthermore, the monitor has a 0.28-mm. dot pitch and uses a short-persistence phosphor. Video bandwidth is 75 MHz. The range for vertical scanning frequencies is 50 to 90 Hz and 30 to 57 kHz for horizontal.

Input signals can come via a variety of cable ports, including mini 15-pin, standard 15-pin, and the three standard BNC-connector signal methods: 3-wire sync on green, 4-wire external composite sync, and 5-wire external composite sync.

COMMAND CONTROL

Most of the 4D's controls are on the bottom front of the case, including the power switch and the controls for brightness and contrast—neither of which has center-position detents. There are four size and position controls, one for each type of horizontal and vertical image adjustment. These controls are set via a pair of buttons which step up or down through a range of settings, which change the factory defaults and customize special user settings.

Other front-mounted controls include an input voltage switch to match displays with video adapters, an input switch that lets you select between BNC and D-sub connectors, a mode switch for moving between factory default settings and user settings, and a memory recall button with which you can reset the customizable factory defaults to their original calibrations. The back of the case has the input connectors, an on/off synchronization switch (you'll turn that off only if you're using a Macintosh II video board), and a degaussing button.

The 4D automatically synchronizes signals and the image's position and size with four standard setting combinations. You may use the picture controls to change them and store the new settings in EPROM until you either change them again or push the memory reset button, which restores everything to the factory default. If you turn the mode switch to "on," you can calibrate four other size and position settings, which will also be saved in nonvolatile memory. In all, there are eight setting combinations: four modified factory defaults and four completely user-calibrated. Since you can have two computers hooked up to the 4D—one via a 15-pin connector



FACT FILE

EDITORS' CHOICE

NEC MultiSync 4D

NEC Technologies Inc., 1255 Michael Dr., Wood Dale, IL 60191; 800-632-4636, 708-880-9500.

List Price: \$1,499 (tilt/swivel base and cable included).

Requires: MCGA, VGA, Super VGA, or 1,024-by-768 graphics adapter.

Diagonal Screen Size: 16 in.

In Short: The NEC MultiSync 4D offers accurate autosizing, custom user modes, and 1,024-by-768 maximum resolution at a 0.28-mm. dot pitch. With a solid reputation and street prices below \$900, the pacesetter MultiSync 4D is the monitor other vendors need to beat.

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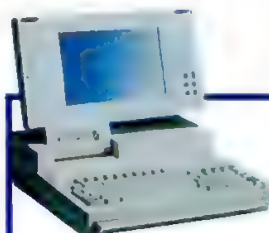


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and the other with BNC connectors—you can easily switch between computers by using the input and user-mode switches.

SOLID PERFORMANCE

The NEC MultiSync 4D did acceptably well on PC Magazine Labs' tests. Jitter, swim, and drift scores were all less than half a line width in both modes, and this was fairly consistent in all colors. Pin-cushioning scores were a bit high, but not enough to notice in normal use. Convergence was good, with only minimal color bleeding.

The NEC MultiSync 4D is a reliable display at a competitive street price. If you want to go bigger, there's always the \$3,699 20-inch MultiSync 5D, but the 4D's 16-inch case is probably as large a monitor as you'll want on your desk.

PHILIPS CONSUMER ELECTRONICS CO.

Philips FC17AS

by John R. Quain



Philips FC17AS, \$2,695.

Branded with one of the highest price tags in this roundup, the \$2,695 17-inch Philips FC17AS didn't do much in the way of performance to remove its sticker stigma. Compared with several less-expensive contenders, the FC17AS's image quality was lackluster, and it accomplished little more—and, on occasion, a little less—than lower-priced displays.

Manufactured by the Italian arm of Philips, the FC17AS accommodates resolutions from VGA to 1,280 by 1,024. The monitor, which can also be purchased through Pixelink Corp. (Hudson, MA; 508-562-4803), weighs about 50 pounds and ships with a tilt/swivel base. Video bandwidth extends up to 110 MHz. Verti-

cal scanning ranges from 50 to 140 Hz, while the horizontal scanning frequency range is 30 kHz to 66 kHz. So if there's a chance you might encounter ancient EGA, the FC17AS is not for you. In addition to its medium- to short-persistence phosphors and a fine 0.26-mm. dot pitch, the manufacturer also ballyhoos its flat screen, though it didn't appear as flat as those of the Idek and IOcomm. To hook up the monitor to your video adapter, Philips provides a BNC-5 input—but no cable. You'll have to go to a third party to finish the connection.

UNFORTUNATELY PLACED CONTROLS

Controls on the front panel include brightness and contrast wheels and a degaussing button. The latter is used to discharge electromagnetic buildup, which can distort the screen image. Monitors are automatically degaussed when you switch them on, but we found that the degaussing feature was a little more efficient than powering the set off and then on again.

Secondary controls for adjusting horizontal size, horizontal position, vertical size, and vertical position are situated on the back of the monitor. Given that the FC17AS can not automatically keep the displayed image the same size when switching graphics modes, this turned out to be an unfortunate arrangement. Redressing the problem a bit is the tilt/swivel base, which, if you have the desk space, can be rotated 360 degrees.

PERFORMANCE DIFFICULTIES

In test results, the Philips FC17AS turned in the worst cumulative line drift, swim, and jitter scores. Here the unblinking perceptions of our Microvision Superspot proved less forgiving than human eyes. The apparent line deformity results did not affect overall picture quality. There was, for example, no line wavering or roping distortion. Straight lines continued unperturbed right out to the corners of the screen. Contributing to the solid appearance of on-screen graphics was the monitor's extremely consistent red, green, and blue line widths.

Potential criticisms presented themselves in terms of convergence difficulties. In the bottom left corner of the screen, the red, green, and blue electron beams diverged slightly when creating a white line. Unfortunately, this was not only apparent when examining narrow, iso-



FACT FILE

Philips FC17AS

Philips Consumer Electronics Co., 800 W. Cummings Park, #2000, Woburn, MA 01801; 617-938-5455. Also available from Pixelink Corp., 8 Kane Industrial Dr., Hudson, MA 01749; 508-562-4803.

List Price: \$2,695 (tilt/swivel base included).

Requires: VGA, Super VGA, 8514/A, or 1,280-by-1,024 graphics adapter.

Diagonal Screen Size: 17 in.

In Short: With a maximum resolution of 1,280 by 1,024 and a 0.26-mm. dot pitch, the Philips FC17AS's performance was generally on a par with most of the monitors in this roundup. Apart from some convergence difficulties and the lack of a cable, the monitor did not exhibit any major problems—that is, if you can cope with its overwhelming price.

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lated lines; with a screenfull of text, characters along the left edge of the image were perceptibly fuzzier than those on the right. Intricate graphics also appeared slightly softer on the left side. Repositioning the monitor and degaussing did not alleviate the problem.

DULL GRAPHICS

The only other criticism of the FC17AS was our unshakeable impression that graphics looked duller on this set when compared with its peers. Increasing the brightness did much to reduce this perception. With the monitor switched off, the culprit appeared to be the shadow-mask and glass combination, which didn't appear as dark as possible (though it was comparable to several other monitors). Sophisticated electronics aside, black images will only be as dark as the monitor's glass/shadow mask faceplate. In this case, boosting the contrast wasn't enough to compensate.

Certified by the FCC for Class B operation, the Philips FC17AS didn't exhibit any really disturbing problems. It didn't elicit any raves, either. As with high-end audio speakers, much of the impression a monitor makes is subjective. Unfortunately for the FC17AS, the on-the-high-side \$2,695 cash outlay makes for an objective yardstick. ■

Kellyn S. Betts is a frequent contributor to PC Magazine. Bruce Brown, Bill O'Brien and Alfred Poor are contributing editors of PC Magazine. John R. Quain is a contributing editor of Video Review magazine and a frequent contributor to PC Magazine.

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Technical Graphics Packages

by Mitt Jones

That technical people need something different in a graphics package from the rest of us is a marked understatement. The ability to plot the colossal volume of data often generated by experimentation single-handedly renders most generic graphics packages unsuitable for scientific use. Other important differences, as well as the need to plot so many data points in the first place, result from a fundamental divergence in the way managers and researchers use data: While the average manager is typically interested in presenting the trends or broad implications to be gleaned from the pertinent data—through graphs of aggregate sums, averages, and the like—the researcher often needs to illustrate the data itself, along with the curve of a function that describes the data accurately.

Scientists and engineers have special needs, and technical graphics packages are there to meet them. We evaluate a dozen 2-D and 3-D graphics packages aimed at a technical audience.

The makers of some business and presentation graphics packages, spreadsheets, and statistical analysis software have made progress toward accommodating technical users. But differences in focus and structure still make them far from ideal for scientific graphics. An especially feature-laden presentation graphics program might allow you to plot a 5,000-point data set, fit an exponential curve to the data, and change to semi-log axes, but its focus on pie charts, special effects, and the other niceties that go into a typical slide show leave technical types feeling a bit like a master portraitist handed an assortment of Day-Glo spray paints.

Similarly, a spreadsheet program's focus on data handling and manipulation makes organizing your data a snap, but even the most science-minded graphics modules don't offer the mathematical sophistication and technical graphics features required for heavy technical charting. And the graphics modules of the better statistical analysis packages hit the mark mathematically, but they fall short when it comes to adding the necessary touches to technical charts. They also typically cost a good bit more than a standalone scientific graphics package.

Fortunately, the field of packages designed specifically for technical applications is growing wider and more mature than ever. Whether you've been calling on the services of a drafter, making do with an almost-does-it generic package, or using one of the old breed of scientific graphics packages, you should find a tool better suited for generating publication-quality technical graphs in the following pages.

REVIEW CRITERIA

In this second roundup of technical graphics packages—our first since the numerical analysis issue (*PC Magazine*, March 14, 1989)—we review a dozen graphics packages designed to produce high-quality graphs and charts for technical and scientific audiences.

Three of the packages, ranging in price from the \$199 *Grapher* to the \$395 *GraFit* and *Tech*Graph*Pad*, specialize in two-dimensional technical graphs. *Cricket Graph*, at \$129 the least expensive of the packages reviewed here, and *SlideWrite Plus*, at \$445, supplement these capabilities with business-type charting features. *SlideWrite Plus* additionally provides enough drawing tools and high-quality output support to be considered a full-

fledged presentation graphics package. *ProPlot*, at \$169, and *EasyPlot*, at \$349, forgo most business charts but add minimal three-dimensional capability.

Two programs, *SDS* and *Surfer*, focus primarily on three-dimensional plotting and list at \$450 and \$499, respectively. Finally, three heavy hitters do it all: *Axum*, *Graftool*, and *SigmaPlot*. Each of these packages lists at \$495, but they make up for their cost with a comprehensive list of 2-D (and in the case of the first two, 3-D) plots, a full range of charts, powerful mathematical analysis capabilities, and robust data transformation functions. All of the above packages support at least 2,000 data points per chart, and most can handle many more. All but *SDS* and *Surfer*, the three-dimensional packages, also offer several curve-fitting algorithms.

A number of technical graphics packages didn't make it into this roundup but

may be worth a look. For basic two-dimensional plotting, BVE Professional Software's *GrafMaker*, Rsoft Inc.'s *RPlot*, and Scientific Concepts' *MicroPlots* fill the bill, though they were not included in our review because they do not do curve-fitting. *MicroMath's Graph* offers basic plotting and curve fitting, but its inability to accommodate more than 1,024 data points per chart prevented it from being reviewed here. A newcomer to the market, *CSS:Graphics* from StatSoft of Tulsa, Oklahoma, should be on the market by the time you read this but was unavailable at the time of our review. Finally, a low-priced three-dimensional package aimed at the academic market, Bridge Software's \$79 *Datasurf*, was not included because the vendor refused to participate in the review.

DATA COMES FIRST

When choosing between the 12 packages examined in the following reviews, you'll benefit from paying special attention to several factors, starting with data capacity. Most of the packages reviewed here support expanded memory to increase the number of data points they can handle, but only a few can load thousands of data points as a single series. Most of the packages also have inherent limits on the number of curves and the total number of data points allowed per graph, potentially a more serious problem.

Your options for importing the data and editing it should also be of serious concern. All of the 12 packages accept ASCII files in various formats, but only 8 accept Lotus worksheet (.WK1) files. And while most of the packages come with their own limited data sheets, some of these worksheets are little more than crude text editors, a limitation that will force you to exit to your own spreadsheet when you need to limit graphing to a given range, delete a column, or do a bit of transposing.

TO FIT OR NOT TO FIT

Whether you use your scientific graphics package as a data analysis tool or simply to generate the graphs, the ability of programs to fit curves to your data should be a major criterion. All but the two 3-D-only packages (*SDS* and *Surfer*) can fit numerous types of curves, including linear, polynomial, and exponential. Some packages will attempt to fit a line from an equation of your making, which you construct using the program's mathemati-

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cal functions. Data smoothing and interpolation capabilities also vary considerably among the 12 packages.

ProPlot and *Grapher* support absolutely no data transformation functions. At the other end of the spectrum, *Axum* and *Graftool* offer every function and transformation function your heart could desire, including Bessel, error, and Gaussian Q functions.

The programs also differ significantly in the amount of control they offer in examining, arranging, and annotating the curves once you have them graphed. Unless you're doing your detail work elsewhere, you'll want a package with a multilevel zoom feature and scrolling. A cross-hair feature for viewing the values associated with any data point can also be a big help when you've got a few thousand data points scattered about the screen.

THE MORE MARKERS THE MERRIER

One of the most important and subtle differences between a technical graphics package and one meant for business lies with the number of line and data marker symbols available. It's hard to accept when using a VGA monitor, but that green line you plotted in between the yellow and magenta lines will be black like all the others when the graph comes humming out of your laser printer—unless, of course, you plan to use a color printer. To distinguish different data series, all of the packages offer at least one dash pattern in addition to a solid line, and most offer several patterns, along with the ability to create a legend that will make the patterns meaningful. The number of point-marker styles included with the software can vary

from a small handful to several hundred. The best of the lot also offer at least some flexibility in setting the size of data markers, in specifying the range used for the axes, and in placing annotations, labels, and titles. All of these are important features if one is to make a technical graph clear enough and informative enough for publication in a scientific journal or for presentation before an audience.

Of course, all of this number crunching and pixel placing takes an enormous amount of computing power and can consume an irksome amount of time. The reviews should give you a solid idea of whether a given package performs at reasonable speeds under moderate loads without a math coprocessor. But if you'll be subjecting the package of your choice to heavy manipulation and graphing of endless streams of data, make sure you



EDITORS' CHOICE

- **Graftool**
- **Axum**

No technical graphics package can meet every need, but if you're going to spend almost \$500, it's reasonable to ask for one with a good range of both 2-D and 3-D plotting options, robust data handling and transformation functions, and nice-looking output. Two packages in our review fit this standard, and both are worthy, for different reasons, of our Editors' Choice designation.

Graftool (\$495) is the best choice if your concern is primarily data analysis, particularly large amounts of 3-D data. Its industrial-strength capabilities (it handles huge numbers of data points, plots multiple surfaces, and offers many kinds of specialized graphs and plots) are enough to handle just about any scientific plotting task, and its revamped graphical interface (much improved in Version 3.3) makes it easy to rotate and manipulate complex 3-D graphs the way you like them. Its printed output is quite attractive, too.

Unfortunately, *Graftool's* complexity and especially its slow printing speed will make it less than fully suitable for some people. If these considerations are important and you don't need *Graftool's* more

esoteric features, choose *Axum* instead. This well-designed package (also \$495) offers a full set of 2-D plotting options, including multivariate curve-fitting, plus a good selection of the most common 3-D plots and a rich set of statistical functions, all within a character-based menu system that's reasonably easy to use. *Axum* is somewhat more awkward on the detail level than *Graftool* and its output isn't always as attractive, but you won't find yourself standing around waiting for it to print.

Because these two are the best all-around choices doesn't mean you should write off the rest. If you don't need 3-D plotting, for instance, you may prefer *SigmaPlot*, whose superior data transformation and curve-fitting capabilities make it the equal of any in its own province. Its multilayered menu interface is complex, but those who need its power will find it worth adapting to. And an honorable mention in the technical arena is due to *Cricket Graph*. This Windows-based standalone graphing package isn't as full-featured as many of its competitors (especially in data handling), but it does offer the basic

plotting options that most technical people need, and at \$129, you can't beat the price.

The rest of the packages have their points, but they also have significant weaknesses. *Tech*Graph*Pad* and *EasyPlot*, for instance, both have a good, solid mix of features and capabilities, but limited font support in the former and bugs in the latter prevent an unalloyed recommendation at this time. Similarly, *GraFit* is superb at curve fitting and offers eye-catching output, but the version we tested simply isn't versatile enough for general use; moreover, it prints slowly. And even though *SlideWrite Plus* goes well beyond the majority of its competitors in presentation-quality output, its unaccountable lack of support for expanded memory puts crippling limitations on the number of data points that can be plotted.

Far behind in our assessment were the two 3-D-only plotting packages, *Surfer* and *SDS*. Though they do work—and offer some esoteric options that some may find indispensable—their crude design and limited functionality make it hard to justify their high prices.



TECHNICAL GRAPHICS: SUITABILITY TO TASK

The purposes of technical graphics packages can vary, depending on the type of data and the quality of output that you need. Use these informed, subjective ratings to help you decide which package is right for you. Compare them with the product reviews and the features table for a complete picture of what each product offers.

THE TASKS

2-D Technical Graphs is an evaluation of the richness and ease of use of the program's two-dimensional plotting and charting options. To earn a satisfactory score, a program must offer a good range of basic technical plotting capabilities (including x,y, line, scatter, box, and polar plots, with error bars and linear curve fitting), and have usable data-handling facilities. Extra points are given for bar and pie charts, superior data handling and data transformation functions, nonlinear curve fitting and smoothing options, and the ability to plot mathematical functions.

3-D Technical Graphs indicates the product's suitability for plotting three-dimensional data. To earn a satisfactory score, a program must be capable of creating basic surface and contour plots and showing them in multiple fixed perspectives. Extra points are given for non-Cartesian coordinate systems, superior data manipulation, the ability to plot mathematical functions, and interactive control of perspective.

Presentation Output is a measure of the program's ability to create charts for publication or presentation; it is based on the quality of the program's printed output, the breadth of its device support, and the number of its graphics file export capabilities. To earn a satisfactory score, a program must offer a good range of annotation capabilities (including multiple line and point styles, and Greek characters or scientific symbols), good-quality scalable fonts, output to PostScript devices, and the ability to export the chart to a graphics file. Extra points are given for the ability to directly manipulate chart elements in a WYSIWYG environment, color output, drawing tools, and presentation functions like batch printing and word charting.

SUITABILITY TO TASK				
PRODUCT NAME				
	2-D Technical Graphs			
	3-D Technical Graphs			
	Presentation Output			
	2-D Technical Graphs			
	3-D Technical Graphs			
	Presentation Output			

choose a package that does support a math coprocessor.

As with every other category of software, some of the 12 packages reviewed work pretty much the way you'd like them to, while others seem designed as a test of human tolerance and endurance. Fortunately, there seems to be no correlation between simplicity of interface and simplicity of capabilities.

Finally, as for price, it can truthfully be said that the do-it-all, top-of-the-line packages reviewed here cost more in general than the least-powerful 2-D package. But all other price comparisons are fruitless in terms other than how much money will disappear from your checking account once you've made your decision. In addition, the so-called do-it-all packages don't quite do it all. Each suffers at least a bit from its own significant omissions. If you're determined to buy more than you think you really need just to play it safe, make sure the package you buy hasn't neglected the features you can't do without.



If you want a powerful scientific graphics package that's also easy to use, then consider *Axum* from TriMetrix. A one-year-old product from a two-year-old company, *Axum* shows remarkable precocity despite its tender age. Developed by the people who brought you *Gauss*, the well-known math/stat package, this \$495 package can produce a full range of two- and three-dimensional graphs, including scatter plots, surface plots, contours, and filled contours. The program can also handle a wide range of curve fits. Yet *Axum* remains easy to use. The program installs quickly and easily, and its well-designed menus make it relatively easy to navigate for such a complex package.

DATA DELIGHTS

As befits a program of its power, *Axum* handles even large sets of data with ease.

To get data into the program, you can either type it in manually or import it in .WK1 or ASCII form. The number of points is limited only by the amount of

SUITABILITY TO TASK				
AXUM				
	2-D Technical Graphs			
	3-D Technical Graphs			
	Presentation Output			

RAM and disk space you have available (except for 3-D surface and contour plots, which are limited to a 128 by 128 data point grid). In the absence of sufficient RAM, *Axum* can use the hard disk for storage, although this method will sacrifice speed considerably.

Axum provides two methods for stor-



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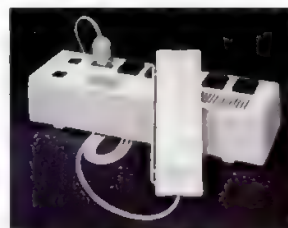
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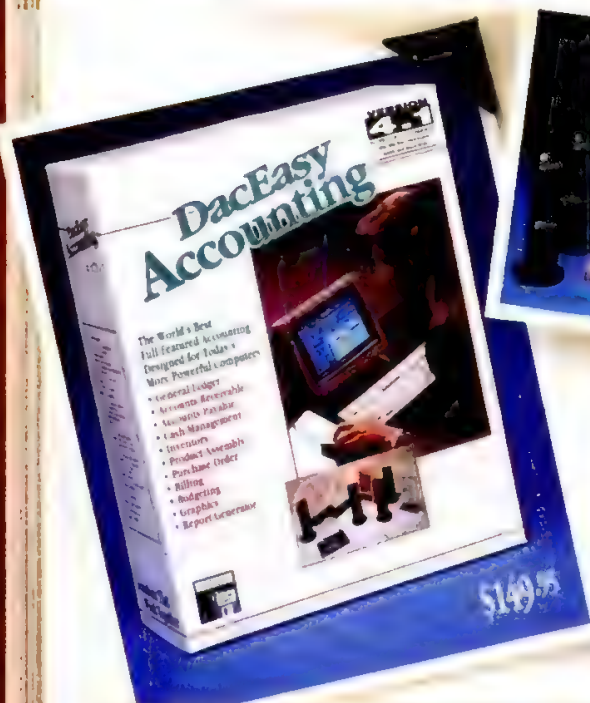


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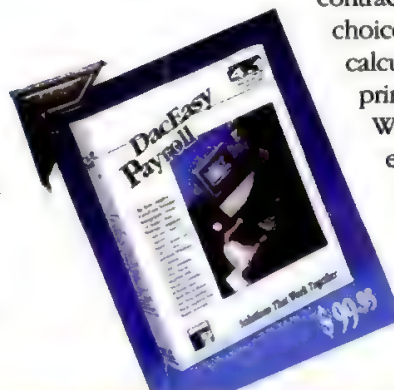
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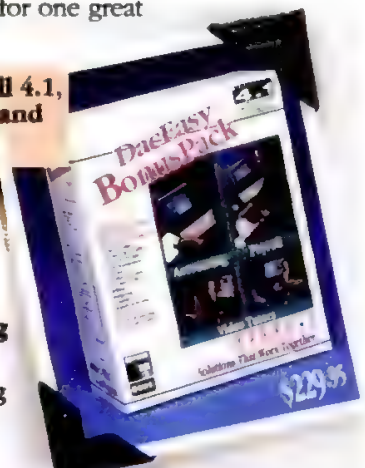


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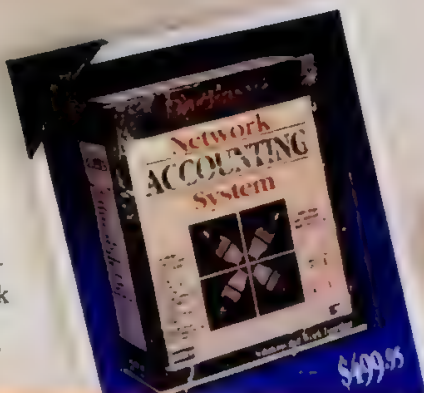
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Axum Surface Plot



Axum is a powerful package that, in addition to 2-D plots, supports a full range of 3-D plots, such as this one.

ing your work. Data sheets, graphs, history logs, and images can all be saved to disk as individual files or combined and saved as *projects*. Essentially, a project is a collection of temporary files saved together as a unit. This feature, which allows you to leave *Axum* and then resume your work easily by simply restoring the project, is particularly useful on a network.

Axum can also be easily installed on a network and run as a multiuser application (site licenses are available). On a network, each user has a separate Project directory. The files stored within the project can be kept separate or shared between users. This setup allows for flexible data management and lets you roll back data to a previous state.

CONVERSION COMPETENT

Axum facilitates file manipulation with well-designed import, export, and editing screens. Many standard numeric operations, as well as changes to data type, can be performed in columns using the data editor's Convert facility. Cumulative sums, natural and base ten logarithms, and floating-to-string conversions are a few of the more than 30 available conversions. Conversion from or to a *missing value*, treated as a distinct data type, can also be performed.

More-complex procedures are available under the transformation window. This facility gives you access to about 100 *Axum* Programming Language functions and commands (such as smoothness, an implementation of the lowest algorithm for locally weighted regression). Based upon a subset of C++, the *Axum*

Programming Language lets you extend its built-in analytical routines with procedures of your own specification. These functions can then be recorded within a history log and executed as a macro, allowing for automation of complicated tasks.

On all but one of the tasks we tried, *Axum* performed very well. The sole exception was the creation of stacked bar charts, which was made unnecessarily difficult by incorrect instructions in the manual. A separate technical note explains how to do this type of chart, which turned out to be easy. Indeed, incorrect and out-of-date documentation is perhaps the program's biggest weakness. Another weakness is the aggregation of data from monthly to quarterly. This function required a five-line *Axum* program to execute; it would be much more efficient if this program were part of a library of utilities.

MAKING GRABBING GRAPHS

Once your data looks just right, *Axum* also gives you a good set of tools for making your graphs look just right. You can control line thickness, tic marks, and axis specifications easily, and the program's built-in graphics editor allows you to position legends, arrows, and other objects interactively, and to make necessary adjustments, including aligning comments within a legend, by changing the values of the coordinates. You can also overlay images, hide and unhide objects, and change the viewpoints on three-dimensional graphs.

Axum's strong font support is a big factor in the program's eye-catching out-

FACT FILE EDITORS' CHOICE

Axum,
Version 1.02
TriMetrix Inc., 444
N.E. Ravenna Blvd.,
#210, Seattle, WA
98115; 800-548-
5653, 206-527-1801.

List Price: \$495

Requires: IBM XT, AT, or compatible; 640K RAM, hard disk, graphics adapter, DOS 3.0 or later. Math coprocessor recommended.

In Short: With a full range of 2-D and 3-D plots as well as powerful data handling and curve fitting functions, this superior package offers a full house for the technical user.



CIRCLE 406 ON READER SERVICE CARD

put. Twenty-one scalable fonts are built in to *Axum*, and you can also use PostScript fonts. You can choose from a wide variety of printers for your output (though *Axum* does not support color PostScript or film recorders), and you can export graphs in many formats including HPGL, EPS and Lotus .PIC (though not the more commonly supported CGM). You can even chain images together into on-screen slide shows.

With its powerful data and graphics editors, its ability to overlay images, and its publication-quality output, *Axum* competes in power and capability with any of the programs in this review. Yet its well-designed menus and context-sensitive help demonstrate that a technical graphics package need not be hard to manage to be good.

Cricket Graph

by Kellyn S. Betts

If simplicity is the key to success, then *Cricket Graph* for *Microsoft Windows* is ready to open some doors. The philosophy behind this package is that graphing capabilities, scientific or otherwise, should be made available as inexpensive, easy-to-use utilities. *Cricket Graph* lets you pull in data from a spreadsheet and graph it quickly, all at the very reasonable price of \$129.

Cricket Graph first made a name for itself as a Macintosh product, and, according to Computer Associates, its makers, approximately 80 percent of its Macintosh customers are scientists and



PerFORM PRO FOR FORMS THAT FOLLOW FUNCTIONS

You use forms to capture and communicate information. You own PCs for the same reason. So why aren't your forms computerized?

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PerFORM PRO lets you implement a complete forms management system immediately.

Or you can start with just the basics, using tools created specifically for form designing. Then expand to electronic form filling when you're ready.

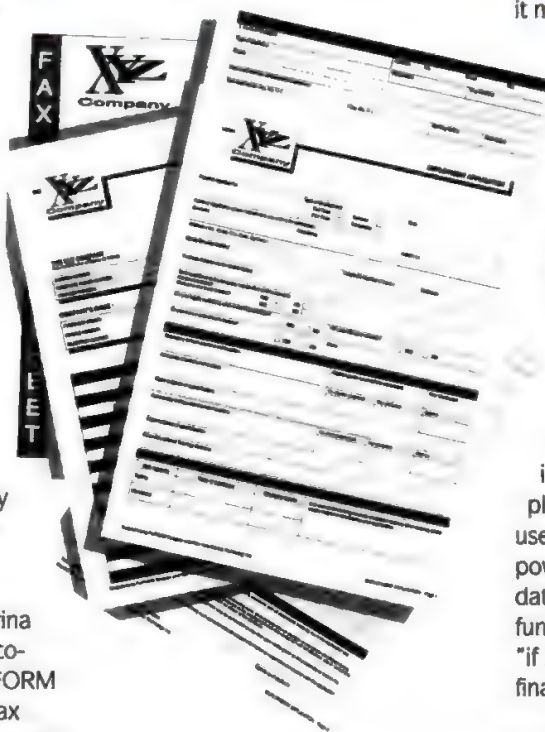
You can add complementary Delrina products. Soon, you'll be able to automatically turn paper forms into PerFORM forms. Right now, you can use WinFax to fax completed forms directly from any Windows application.

Wherever you start, you'll save money. For every \$1 spent printing forms, the average corporation spends another \$60 designing, updating, warehousing, distributing and filling them.

You'll save time too. A leading North American financial institution cut their form-filling time in half when they switched from paper forms to PerFORM forms.

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PerFORM Pro's WYSIWYG "Designer" software runs under Windows 3.0. And



it makes form designing easier and more complete than any of the old ways.

You'll find an array of tools. A wide choice of typefaces. Over 100 sample forms. And the ability to add graphics like your company's logo. For security, PerFORM PRO's powerful electronic signatures can secure data. And the final form design can also be locked.

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PerFORM PRO "Filler" runs stand-alone or networked. And takes the frustration out of form-filling, making it fast, easy and error-free. Multi-platform solutions enable any IBM PC user to take advantage of PerFORM PRO's powerful filling features. Like validation, database lookup, indexing and over 65 functions for automatic math calculations, "if ... then" statements, date functions, financial calculations and more.

PerFORM PRO will read and write to dBASE or ASCII files, sharing common information across several forms. You can create dBASE indexes to help you find data. And you can group related forms together so that common information only has to be entered once. You'll save time with fast printing too, especially on HP LaserJets.

If you're not completely satisfied, return the entire package for a full refund within 60 days.

Ask your dealer about PerFORM PRO today. Or call our toll-free number for more information on the complete forms management solution.

PerFORM PRO



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TECHNOLOGY INC.



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1-800-268-6082

CIRCLE 250 ON READER SERVICE CARD

other technical users. The attraction is obvious: *Cricket Graph* produces a good range of two-dimensional charts, and its technical features: double y-axes, a reasonably wide array of scaling options, calculated error bars, interpolation, and five kinds of univariate curve fitting, cover all the basic functions that most technical users will need. A *Windows* application runs under either *Windows* 2.1 or *Windows* 3.0 and comes with a runtime version of *Windows* 2.1 for *Window*-less users.

IMPRESSIVELY SIMPLE

While *Cricket Graph* may look simple, it can aggregate an impressive amount of data. Its data sheet can hold up to 108,000 individual points, all of which can be displayed on any chart. You can import data into the program from five different spreadsheet and database formats, including tab-delimited ASCII.

Once you have the data in the program's spreadsheet-like data sheet, you can do some fairly extensive column

manipulations. *Cricket Graph* recognizes only columns of data, so to do either row or cell operations, you must first move the data into a column. Columns can be moved around with the standard cut-and-paste commands, as well as sorted, smoothed, or recoded so that all values with a given range are changed to a selected value. The frequency of the occurrence of data values within a column can be counted, and columns can also be added, subtracted, multiplied, or divided by each other or by a constant. You can transform your data

THE MATHEMATICAL ALTERNATIVE

by Barry Simon

There are lots of ways to cut the software pie, and scientific graphics packages aren't the only slice when it comes to technical charting and graphing. Most mathematical and statistical toolboxes come with some graphics ability, and, depending on your needs, they may be a better choice than a dedicated technical charting package.

Most technical graphics programs will do nicely if you are mainly showing raw experimental data, with perhaps a theoretical function or two. But they tend not to be up to snuff when it comes to plotting very complicated engineering and scientific functions. This is especially true if the functions you want to plot are only implicitly defined—through some algebraic or differential equation, that is. In such cases, a math toolbox may be what you need.

As our last surveys of symbolic math packages showed (see "The New World of Higher Math," *PC Magazine*, May 29, 1990 and "Better Tools for Higher Math: When Numbers Count," March 14, 1989), the strength of these products lies in their powerful tools for manipulating mathematical objects. With a math toolbox, you can solve multiple nonlinear equations, do matrix manipulations, and analyze associated differential equations, plotting the results on one or more graphs.

A TOOLBOX OF TECHNIQUES

The great advantage of this approach to scientific graphing is that it lets you set up powerful interactive links between computations and pictures. For

example, math packages make it possible for you to study eigenvalues of a matrix depending parametrically on some variables and functionally on others, examining the graphs of the functional dependence as you vary the parameters. Many of these math packages offer full-fledged programming languages, and all have enough equation solving capabilities to make them more than a match, analytically, for even the most sophisticated technical graphics programs.

GRAPHICALLY GRAND

The strongest contender in the graphics department is *Mathematica*, from Wolfram Research. Its current version offers striking three-dimensional plots that let you adjust the view for effects of perspective and differing types and positions of light sources. The only drawback is that these options need to be set via a command line with a rather arcane syntax. However, Wolfram has announced a *Windows* 3.0 version of *Mathematica* (which should be available by the time you read this), that will use a notebook interface similar to that of their Macintosh product. This will let you make interactive changes to your graphs—an enormous improvement.

Maple, from Waterloo Maple Software, is also working on a new version that tremendously improves its previously weak graphics. This version supports two- and three-dimensional plots and lets you call up menus to customize details. Particularly elegant is its method of rotating a three-dimensional plot: You can pop up a box with

a cube frame, use cursor keys to rotate it visually, and then hit Enter to have the full plot redrawn at the new viewing angles.

Gauss from Aptech Systems provides two acceptable levels of graphics: publication quality and quick graphics. The level you choose will depend as much on the amount of time you are willing to wait for the drawing to emerge as on your needs. The output of what Aptech calls its "publication-quality graphics" is excellent, but even its "quick graphics" is adequate for many applications. *Gauss* lets you create two- and three-dimensional plots, contour plots, bar graphs, histograms, and polar plots; it even lets you customize graphs using its rather spare command-line interface, which even technical users may find unfriendly. It doesn't support PostScript printers, however.

The upside of using *MathCAD* (from Mathsoft) is its easy-to-use scratchpad. The downside is that you get only scratchpad-quality graphs, rather ironic for a program that runs in graphics mode. *MathCAD* graphs are easy to create; the program produces both two- and three-dimensional plots and supports a variety of printers. If productivity is paramount and your graphs don't need to be publication quality, it's an acceptable choice.

Finally, *Derive* from SoftWare-house (recently upgraded to add a few programming constructs and many new canned functions) remains a great bargain. Its exact rational arithmetic, symbolic manipulation, and calculational basics are supplemented by

GRAPHICS TECHNICAL CHARTING

using ten different operations, though you can't use complex equations. More-complex transformations, as well as manipulation of discrete series of rows within columns, can be done within your spreadsheet, however.

One of the nicest things about *Cricket Graph's* data window is that it allows you to rename columns to serve as titles for the data beneath them. To do this, you need only click on the column name with your mouse (*Cricket Graph* requires a mouse), and type in the new name in typical *Win-*

dows fashion. You choose which data you will graph based on the column names you specify, and these names become the axis labels for the graph. In addition, the format options for columns are extensive enough to allow you to specify how many points beyond the decimal place should be considered for graphing.

SCALING NEW HEIGHTS

When you create a graph, *Cricket* automatically labels and scales it for you.

considerable graphical ability. You can display up to four graphs on the screen, both two- and three- dimensional, and manipulate them easily with a menu similar in format to *Microsoft Word's*. *Derive's* Achilles' heel is its lack of direct printer support: The only way to print out a graph is to capture the screen. It also lacks graphics file export functions.

None of these products is strong on links to file formats supported by high-end word processors or desktop publishing programs, and the printed output (especially from *Derive* and *MathCAD*) can leave much to be desired. Support for on-screen slide shows and links to outside slide services are also lacking. Still, if your graphics need to be tightly coupled to powerful mathematical functions, they're a tasty temptation.

Derive, Version 2.0

Soft Warehouse Inc., 3615 Harding Ave., #505, Honolulu, HI 96816; 808-734-5801.

List Price: \$250

Requires: IBM XT, AT, or compatible; 512K RAM (640K RAM recommended), DOS 2.1 or later.

CIRCLE 400 ON READER SERVICE CARD

Gauss-386 and *Gauss*, Version 2.0

Aptech Systems, 26250 196th Place South East, Kent, WA 98042; 206-631-6679.

List Price: *Gauss-386*, \$695; *Gauss* 2.0, \$495

Requires: IBM XT, AT, or compatible; 640K RAM, DOS 3.0 or later, math coprocessor. *Gauss-386*

requires an 80386-based PC.

CIRCLE 401 ON READER SERVICE CARD

Maple, Version 4.3.1

Maple Software, 160 Columbia St. West, Waterloo, Ontario, Canada N2L 3L3; 519-747-2373.

List Price: \$695

Requires: 386-based PC with math coprocessor or 486-based PC, 2MB RAM (4MB recommended), CGA, EGA, or VGA graphics adapter, DOS 3.3 or later.

CIRCLE 402 ON READER SERVICE CARD

Mathematica, MSDOS 386

Version 1.2

Wolfram Research Inc., 100 Trade Center Dr., Champaign, IL 61820; 217-398-0700, 800-441-6284 (orders only).

List Price: No-coprocessor version, \$695; 80287/80387 version, \$995; Weitek 1167/3167 coprocessor version, \$1,295.

Requires: 386 or 486-based PC, 2MB RAM (4MB recommended), graphics adapter, DOS 3.0 or later.

CIRCLE 403 ON READER SERVICE CARD

MathCAD, Version 2.5

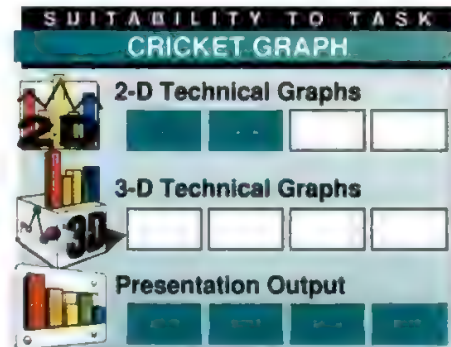
MathSoft, 201 Broadway, Cambridge, MA 02139; 800-628-4223, 617-577-1017 (in Massachusetts).

List Price: \$495 (academic discounts available)

Requires: IBM XT, AT, or compatible; 512K RAM (640K RAM recommended), graphics adapter, DOS 2.0 or later. Math coprocessor recommended.

CIRCLE 404 ON READER SERVICE CARD

Because of the vector-based program's graphical nature, it is extremely easy to change the defaults: all you do is click on whatever you'd like to change, including the title, axis, graph size, or plot symbol. The item you select will be given handles



if its size can be changed or a dashed-line box if its attributes are alterable. For changing attributes, a box pops up that shows you what defaults were used in the existing graph and what additional attributes are available. Almost all graph-alteration tasks are extremely intuitive; for example, to explode a pie slice, you simply click on it and then pull it away from the pie.

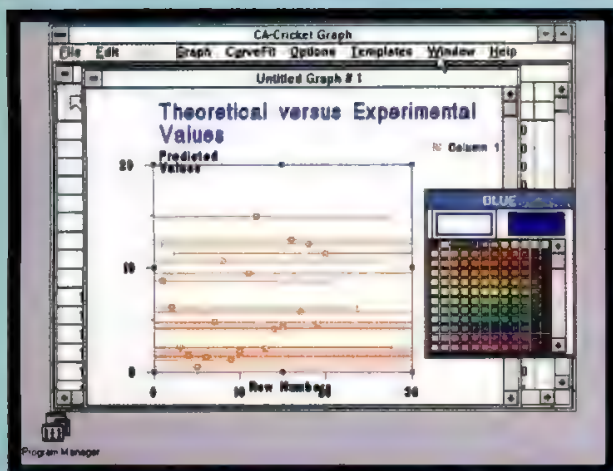
The quality of *Cricket Graph's* charts is also worth mentioning. In an attempt to achieve maximum results with minimum effort, it offers templates that allow you to create standard formats in which to present your data. And when it comes to drawing and annotation, *Cricket* really shines: Though it provides but seven drawing tools, including three different types of arrows, using them is extremely intuitive and easy. The same goes for the coloring tool, which supports 256 colors and can be modified to create custom colors.

For output, you can print both in color and in black and white to any of the wide range of printers and plotters that *Windows* supports. You can even create 35-mm. slides, transparencies, and prints: *Cricket Graph* comes with a communications program called CA-Agrx that lets you send files directly to the Autographix slide service bureau. For output to word processed or desktop publishing documents, *Cricket Graph* exports graphs in CGM format.

FAR FEWER FLAWS

Though most of the bugs that plagued earlier versions of the program have been ironed out, *Cricket Graph* still does have

GRAPHICS TECHNICAL CHARTING



Cricket Graph offers intuitive, easy-to-use 2-D graphing. Its coloring tool supports 256 colors and can be modified to create custom colors.

a few irritating flaws. When initially creating a graph, the program bases its internal description upon the selected output device, and changing output devices can cause strange things to happen. For example, in our test we set up the screen rather than the printer as the output device; when we tried to switch to the printer, the image stuck. In addition, its mapping from color to black and white can be a nightmare. If the filename you choose for a graph is too long, *Cricket Graph* won't allow you to save it, but it won't beep at you or warn you to change the name, either. Finally, the scroll bars that allow you to move around inside files behave as if every file were 2,700 rows by 40 columns wide, so there's no easy way to find the end of your data other than paging through it.

None of these flaws are fatal, so if you're a *Windows* user with relatively simple technical graphing needs, this very inexpensive package is well worth your consideration. And if you've never tried *Windows*, this might be just the thing to get you started.

EasyPlot

by Mitt Jones

Spiral Software's \$349 *EasyPlot* combines a good range of mathematical capabilities with fairly speedy graphing and printing—what you'd expect from a program created to meet the needs of researchers at MIT's Lincoln Laboratory. To those acquainted with the stubborn austerity of most academic software, *EasyPlot*'s slick graphical user interface and thoughtful touches may seem just short of a miracle. This miracle is tainted, though, by a series of substantial glitches and a few conspicuous omissions.

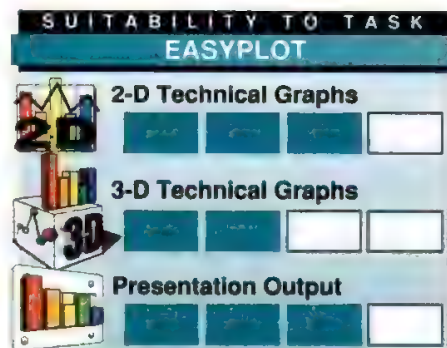
Easy start-up and mathematical flexibility are *EasyPlot*'s strong suits. Each time you start the program, it queries you for a data file. As long as the file conforms to ASCII, comma-delimited ASCII, or .WK1 format, the program automatically imports the data and graphs it according to its defaults. Alternatively, you can enter an equation you'd like to graph at the file prompt or enter data manually from the keyboard. Graphs appear quickly, thanks to the program's assembly-language screen-writing routines.

Once you have your graph, you can fit curves to it using *EasyPlot*'s wonderfully

fast polynomial-fitting algorithm, or choose from a small collection of predefined equations that use an iterative technique (also fairly quick, even without a math coprocessor). You can also enter your own equation using any of the program's 18 predefined functions. In a twist that goes beyond the merely novel, *EasyPlot* allows you to choose portions of data to be acted upon by regressions, spline interpolations, transformations, and data smoothing simply by zooming to show only the data you want on the graph. This technique also works to limit the range of the integration function and the differentiation function.

LEARNING THE ROPES

EasyPlot's proprietary graphical user interface looks good and, for the most part, works well, but a few of its departures from the norm bear mention. The pull-down menus begin with a File menu at the upper left of the screen, as in *Windows*, but here you must open files by choosing the Graph or Curve options from the Add menu. Though this is awkward and confusing, *EasyPlot*'s ability to accommodate an unlimited number of curves per graph and an unlimited number of open, layered graphs will make you for-



give the inconsistency of its interface quickly enough.

Some of the program's more useful features are easy to miss at first. Rather than list all chart types in one menu, *EasyPlot* sprinkles them about the menus or makes them implicit options. For instance, to plot a histogram, you read in the data, pull down the Tools menu, choose the Stats submenu, then choose Histogram, which hides rather effectively among the differentiation and integration functions. And though the program can produce contour diagrams rather than a series of two-dimensional curves, if your data file contains less than 20 columns,



FACT FILE

Cricket Graph,
Version 1.3
Computer
Associates
International Inc.,
1240 McKay Dr.,
San Jose, CA
95131; 408-432-
1727.

List Price: \$129

Requires: IBM AT or compatible; 2MB RAM,
hard disk, DOS 3.1 or later, Microsoft
Windows 2.1 or 3.0. Mouse and EGA or VGA
graphics adapter recommended.

In Short: This package produces only simple
2-D graphs and could use some improvement
in data handling, but it has the basics that
technical users need, and produces snappy-
looking output—at an unbeatable price.

CIRCLE 406 ON READER SERVICE CARD



Here's what they're saying about Ami Pro from Lotus.

“Independent User Survey For Windows.^{TM*}”

Word Processing Features	Ami Pro <i>for Windows</i>	Word for Windows	WordPerfect for DOS
Best Overall	50%	22%	16%
Ease of Learning	47%	28%	8%
Ease of Use	52%	23%	8%

*Independently commissioned Windows word processor Usage and Attitude Study conducted November 1990

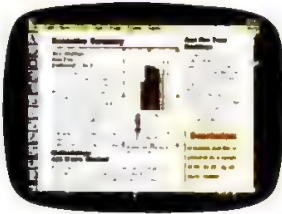
Here's why th



WYSIWYG

No wonder Ami Pro™ for Windows™ is getting rave reviews from users.* They're naturally impressed by its 360 powerful features. And even more impressed with how

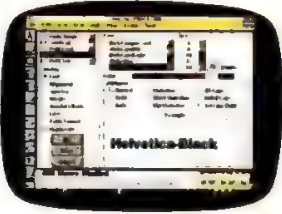
easy it is to use them. Ami Pro has everything you expect in a power word processor, plus important features you can't find anywhere else—like truly interactive WYSIWYG that lets you edit in any of four page views, including full-page view.



FRAMES

Our exclusive "frames" feature lets you quickly place text and graphic elements where you want. Just position your frame anywhere on the page, then fill it with words,

drawings or imported graphics. With a click of the mouse, your text automatically wraps around it.



DIALOG BOXES

Why settle for difficult programs that produce boring documents? Our friendly, interactive Dialog Boxes display all your layout options—and show you the results of

commands before you execute them. So you can change your mind without wasting time.



CHARTS AND GRAPHS

In addition to a built-in drawing feature, Ami Pro instantly generates 168 varieties of presentation-quality charts and graphs, including 2-D, 3-D and perspective. Just type

in the data, or import your chart information from programs like Lotus® 1-2-3.*

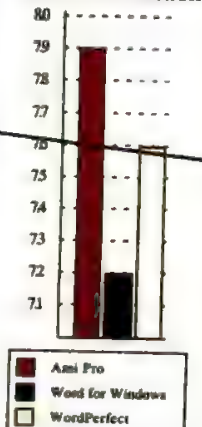
User Study Matches Expert Reviews

User preference research findings have an uncanny resemblance to what word processing and technology experts have been saying all along: Ami Pro is the new standard for word processing in the Windows environment.

The Software Digest rating, for example, places Ami Pro well above Microsoft's Word for Windows and WordPerfect in terms of overall performance.

The user research shows similar results. Ami Pro consistently outranked Word for Windows and WordPerfect in terms of

Software Digest Overall Evaluation



MEMORANDUM

Lotus Development Word Processing Division
BRS Research Services, Inc.
November 5, 1990

USER PREFERRED WORD PROCESSOR

Executive Summary

Key findings:
Ami Pro preferred 2 to 1

Users prefer Ami Pro from Lotus more than 2 to 1 over Microsoft Word for Windows and WordPerfect. Half of the users studied ranked Ami Pro as the "Best Overall" Windows word processor and overall word processing product. 51.9% said Ami Pro was easier than Word for Windows and WordPerfect; 47.3% said it was easiest to learn. A whopping 63% said they are extremely enthusiastic about product or like it better than

Methodology: 42

This independent study was November, 1990. A random processing users were called attitudes and user experience.



Easiest to U

ey're saying it.

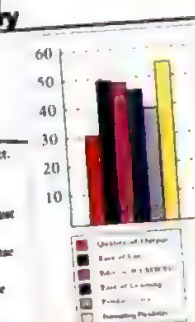
Booth Research Services, Inc.

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Ami Pro, the
y important

Booth Research Services, Inc.

REFERENCE STUDY: PROCESSING FOR WINDOWS



Users Studied
ducted over a three week period in
ple of more than 1,000 word
etailed interviews on preference.

Ami Pro Tops Rankings

Ami Pro came out on top on nearly all of the 17 characteristics ranked by users. An impressive 51.9% of the respondents rated Ami Pro easiest to use, while a whopping 56.5% gave Ami Pro top consideration for "Formatting Flexibility". Although not cited in this chart, users also ranked Ami Pro as top in desktop publishing (60.3%), and in getting the most out of Windows (41.2%).

Conclusion:

In general, Ami Pro is preferred by a margin of 66% to 82% by all users studied.

FEATURES COMPARISON

Feature	Ami Pro	Word for Windows	WordPerfect 5.1
Interactive WYSIWYG	Yes	Yes	No
On-Screen Font and Attribution	Yes	Yes	No
Auto Text Wrap Around Graphics	Yes	No	Yes
Editable View Levels	Yes	No	No
Global Style Sheets	Yes	No	No
Thesaurus Offers Word Meanings	Yes	Yes	No
Visual Dialog Boxes	Yes	No	No
Internal Chart Generation (10 Types)	Yes	No	No



STYLE SHEETS

Ami Pro comes with more than two dozen style sheets that have the page layout already set up and ready to go. So you can produce professionally designed business letters,

memos, reports, presentations, newsletters and more—in just the time it takes to type in text.



EXPERTS AGREE

It's easy to see why users prefer Ami Pro from Lotus two to one over Microsoft® Word for Windows™ for overall features and ease of use. And why it's received top ratings from virtually all the industry experts, racking

up such coveted awards as PC World's Best Buy. The Buyers Assurance Seal from InfoWorld. And PC Magazine's Editor's Choice.

"Ami Pro received a score in Ease of Use of the User Interface that was fully 10 points higher than the next highest score, and came in 14 points ahead of the score WordPerfect™ 5.1 drew from its buyers," according to PC Week's Corporate Satisfaction Poll.

PC Magazine says, "Ami Pro has the friendliest interface and the widest range of functions...[It] is easier to use than almost any program with comparable powers."**

Ami Pro is the word processing program that takes full advantage of the Windows environment, combining power word processing with the power to create professional documents fast. And with its icons and interactive features, Ami Pro is incredibly easy to learn and use. So what do you say? You've just learned about five major Ami Pro features.

Now to find out about the other 355—and how to get a free working model—turn the page.

This says it all.

Automatic Backup Automatic Timed Save Block Manipulation Bookmarks

- Named By User • Go To

Charting

- 3D Charting • Edit Chart with Draw Tools
- Legends • Multiple Styles Per Type • 7 Chart Types

Copy Text and Graphics Cursor Movement

- Begin/End of File • Character • Line • Page
- Paragraph • Sentence • Top/Bottom of Screen • Word

Customizable Icon Bar

- Choose From Over 45 Functions • Quick Access to Features

Customizable View Level

- 10-400% • Fully Editable

Cut and Paste

Date Insertion

- Today's Date • Date Printed • Date Last Edited • Definable Style

DDE (Dynamic Data Exchange)

- Two-way • Paste Link • Text and Graphics
- Via Macro Language

Defaults

- Backup Options • Date Styles • Dictionary Paths • Display Options • Document Path
- Draft Mode Colors • Footnote Options
- Hyphenation Hot Zone • Pair Kerning • Printer Icon Bar Icons • Undo Levels • View Level

Delete

Dialog Boxes

Document Annotation

- Notes • Show/Hide • Go To Notes • Date/Time Stamp • Stacked Notes

Document Descriptions

- Author Name • Operator Name • Revision Number • Creation Date • Revision Date
- Renamable Fields • User Defined Fields
- Display with Directory • Print with Document

Drawing

- Cut/Paste Objects • Circles • Arcs • Squares
- Rectangles • Rounded Boxes • Diagonals
- Polygons • Polylines • Group Objects
- Snap-To Grid • Fill Patterns • Line Widths
- Text Rotation • Type Text

File Import/Export

- AdvanceWrite • ASCII • DBase • DCA Final Form • DCA Revisable Form • DIF • E-Mail
- Enable • Lotus WKS, WK1, WK3 • Microsoft

- Word • Microsoft Word for Windows • Multi-mate • Navy DIF • Peachtext • Rich Text Format • Samna Word • Windows Write
- WordPerfect • WordStar • Wordstar 2000

File Management Functions

- Copy • Rename • Delete • Move • Sorted File Listing

Font Control

- Unlimited Number of Fonts • WYSIWYG
- Limited Only by Printer

Footnotes

- Auto Numbering • Bottom of Page • Endnotes • Number Style Option • Reset Number Option • Separator Line

Forms Capability

- Format Complicated Forms • Fill-In On-Screen
- Print on Preprinted Form • Protect Areas

Frames

- Anchor to Text • Auto Text Wrap Around
- Background Shade • Contain Text or Graphics • Fixed Position On Page • Lines Around • No Text Wrap Around • No Text Wrap Beside • Overlay Frames • Repeat on Multiple Pages • Resize Frames

Glossary

- Large Record Size • Speed Key Access

Go To

- Any Page Number • Fast Next Item Access
- Go To Frame, Footnote, Note, Various Marks in Document

Graphics Control

- Edit PIC Files • Drop Anywhere on Page
- Float Graphic w/Text • Place in Box • Proportional Scaling • Fit in Frame • Rotate in Single Degree Steps • X-Y Scaling • Gutter/Binding Margins

Graphics Import

- CGM • EPS • HPGL • Lotus PIC • PCX
- TIFF • WMF

Hard Space

Headers/Footers

- Alternating • Floating

Help

- CBT Tutorial Available • Context-Sensitive
- Indexed • Point & Shoot • Hypertext Linked
- Full Macro Documentation On-Line

Hyphenation

- As-You-Type • Soft Hyphen • Consecutive Hyphen Control • On Paragraph Basis • Hot Zone

Image Processing

- Control Brightness, Contrast of Scanned, Gray Scale TIFF Pictures • Sharpen Edges

- Smoothing • Invert Image

Index Generation

- Generate from List • Mark in Text • Multiple Level Indexing • Hyper Links from Index Back into Document

Insert/Typeover

Kerning

Line Numbering

Line Spacing Control

Macros/Programming Language

- On-Line Macro Documentation • Record/Play • Assign to Function Key • Assign to Menus • Create Menus • Variables • If • Go To Statements • Case Statements • For/Next
- Prompt for Input • Subroutines

Math Calculations

Measurements

- Centimeters • Inches • Picas • Points

Merge

- From ASCII Files • From Comma Delimited Files • From DIF Files • From WK* Files • From dBase Files • From Ami Pro File • Label Print Function • Preview Before Print • Three-Level Boolean Conditional Record Inclusion

Open Multiple Documents

Page Breaks

- Manually Inserted • With Paragraph Style

Page Formatting Control

- Margins • Page Size • Snaking Columns
- Line Around Page • Line Between Columns
- Portrait/Landscape

Page Numbers

- Any Location on Page • Reset Page Number
- Five Formats for Number

Paragraph Styles

- Quick Access with Styles Box • With Function Key • Controls: Font, Alignment, Spacing, Page Breaks, Ruling Lines, Bullets, Numeric Format in Table, Hyphenation

Printing Color

Print Options

- Over 130 Printers Supported • Number of Copies • Page Range • Reverse Order
- Collate • Print Document Description • Crop Marks • On Preprinted Form • Printer Bin Control for First/Rest Pages • Portrait or Landscape

Real-Time Pagination

Revert to Saved Version

Search and Replace

- Case Insensitive • Forward or Backward
- Header/Footer/Footnote • Skip • Replace

- Replace All • Search for Style • Search by Attribute • Wildcards

Section Outline Numbering

- 6 Levels • Number Paragraphs • Numbered Lists • User-Defined Reset

Snaking Columns

- Up to 8 Columns • Column Balancing • On Screen • Variable Width • Variable Spaced

Sort

- Alphabetic • Numeric • Ascending • Descending • By Paragraph • By Word • By Number of Lines • 3 Levels—3 Words Within each Level

Spelling Check

- 130,000 Word Dictionary • Add to Dictionary
- Correct Multiple Occurrences • Entire Document • Selected Text • International Dictionaries • Rest of Document • Skip All Occurrences • Statistics Report • Unlimited User Dictionary Size

Status Line

- Column Number • Document Name • Insert/Typeover • Line Number • Page Number

Style Sheets

- 27 Professionally Designed • Control All Formatting in Document • Document-Only Styles • Global Styles

Tables

- Up to 256 Columns • Column Width Control
- Row Height Control • Auto Row Height
- Lines around Cells • Shaded Cells • Connected Cells • Formulas: Four-Function Math, Sum Function, Absolute/Relative Cell Address
- Insert Rows and Columns • Numeric Alignment and Formatting

Table of Contents

- 3 Levels • Separator Choice

Tabs

- Center • Leader Dot • Left • Numeric • Right

Text Enhancements

- Bold • Double Underline • Initial Caps • Italic
- Lowercase • Overstrike • Small Caps • Subscript • Superscript • Underline • Uppercase
- Word Underline

Thesaurus

- 14 Million Alternatives • Definitions • Gives Inflections • Synonyms

Undo

- Four-Level • Customizable

Unlimited Document Size

Vertical Centering

Widow/Orphan Control

Word Count

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*Lacks some features including thesaurus, spell checker and ability to save files. InfoWorld's Buyers Assurance Seal awarded August 13, 1990 to Ami Pro 1.2
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TECHNICAL GRAPHICS: SUMMARY OF FEATURES

This table compares the features of the technical graphics packages we reviewed. Note that some packages (notably *SDS* and *Surfer*) are designed for three-dimensional plotting only and consequently do not have some of the 2-D plotting features and options listed.

Interface type indicates the basic operating mode within which the software works. A program is considered to have a graphical interface if it operates entirely in graphics mode. Programs that use character-mode tables and menus are considered to have a character interface even if they have graphical preview modes.

Batch or script language indicates whether the product's functions can be duplicated by means of programs or scripts.

Two-dimensional plotting shows the product's support for the various types of two-dimensional data plots. *Scatter plots* show points are plotted on an *x,y* plane. *X,y plots* and *line plots* draw lines between the points but differ in that the former presupposes a continuous *x*-axis scale while the latter has discrete *x* values. A *jointed* line plot simply connects the points; a *smooth* line plot interpolates points to give a smoother appearance to the line. In *stepped* line plots, the transitions between points are vertical rather than angled, giving a stairstep appearance.

Hi-lo and *hi-lo-open-close* bars show the extremes of data as well as the data itself. They can be used to show experimental error, but this is typically done with *error bars* (see below). *Polar plots* are plots of data in angular (polar) coordinates.

Three-dimensional plotting shows the product's ability to plot three-dimensional data. A *surface plot* shows a 3-D wireframe or surfaced representation of the surface defined by the points, while a *filled surface plot* shows it as a solid object; and a *contour plot* shows a projection of the surface on a plane, with lines indicating the elevations. Some packages are capable of printing both surface and contour plots on the same graph (*combination surface/contour plot*). Other 3-D graphs include *3-D scatter plots* (showing points in *x,y,z* space) and *carpet plots* (filled surface plots with a discrete scale along one axis). Some packages let you *rotate 3-D plots interactively* on the screen so that you can examine them from different angles.

Plotting options shows the various options that apply to two- and three-dimensional plots.

Some packages support both *extrapolation* and *interpolation* on line plots. Most have special *error bars* functions, which can be generated in three ways: by plotting the high and low values from a data file, by specifying a range, or by specifying a given standard deviation. All of these are distinct from simulating error bars using hi-lo graphs. *Curve fitting* indicates the various mathematical methods that the product can use to best-fit curves. *Plot math functions* indicates whether the product can let you generate data from a specified mathematical function and plot it.

Graph curve data as points indicates whether you can plot a derived curve or function as a scatter plot instead of as a curve, while *save curve data to file* indicates whether you can save the data generated by the curve fit or function in a data file that can be plotted or transformed later. *Display equation as annotation* indicates whether the program can automatically label your finished plot with the equation it used.

Business and technical charting In addition to plotting points, many packages can generate various types of *bar charts*, *pie charts*, and *area charts*, which are useful for showing technical data as well as business information. A number produce *histograms* as well.

Some packages have a dedicated *line over bar chart* function (sometimes called a *mixed* or *combination* chart), but others are more flexible, allowing you to overlay any graph on any other graph. If so, the table indicates the maximum number of plots you can overlay.

Data handling assesses functions used for importing data. Most packages import from at least one type of ASCII text file (including print-image files such as Lotus .PRN files) and allow you to enter data from the keyboard; many can import Lotus worksheets as well. *Live link to worksheet file* indicates whether the product can use a .WK1 or other spreadsheet file as a data sheet instead of having to import the data into its own data sheet. *Paste link to worksheet file* (for Microsoft Windows applications) indicates whether the product supports a DDE link to Windows applications such as Microsoft Excel.

Data transformation functions shows the functions for manipulating and editing data in the data sheet. *Data sheet operations* indicates whether the product has the functions to perform Boolean or logical operations on the data (for example, if *x* is less than 0, skip it), to recode values (for example, if *x* is between 1 and 2, code it in class 1), and to merge data files. *Mathematical functions* indicates what types of

mathematical transformations the product can perform on the data, while *data-smoothing functions* shows the various methods by which data can be transformed so as to smooth the plotted curve.

Data reporting functions shows the product's functions for analyzing the data numerically, including *summary statistics*, the *correlation* and *regression coefficients*, and *goodness-of-fit tests*. Graphical methods of analysis include the ability to *view selected graph values* (that is, to view the values and statistics of particular points on the graph).

Axis and scaling options shows the product's ability to create graphs with multiple axes and logarithmic scales. *Probabilistic scaling* means the ability to create a scale that mirrors a normal distribution.

Graph formatting options indicates various features for handling titles, legends, data labels, and text annotations, as well as indicating the product's support for line and point styles, fill patterns, and colors in plots and charts.

Annotation refers to features used for annotating graphs: *Drawing tools* for lines, arrows, boxes, and so on, *image manipulation tools* for making global changes to chart elements (such as aligning them to a common baseline, or rotating them), and *workspace control tools* for managing the graphs on-screen. The ability to import clip art or other graphics images for annotation purposes is also noted.

Text handling covers the product's ability to handle text and use fonts. Most packages have *built-in scalable fonts* that can print on dot matrix, ink jet, and laser printers alike; some also offer *printer font support* for the cartridge and downloaded fonts in your laser printer. Some even offer full-fledged *text editors* or *word-wrap text frames* for entering paragraphs of text on the graph. And although some products let you create different types of *word charts*, none offer a *spell-checker* for checking the text on your graphs.

Output options and devices shows the product's support for various printers, plotters, and film recorders, as well as its ability to export completed charts to various graphics file formats. Some output options include the ability to view the chart on the screen (*print preview*), the ability to print multiple graphs on a single page (*maximum graphs per page*), and the ability to *print to a file*.

Video support shows the product's support for the various PC video standards and its ability to display colors on the screen.

CONTINUES

GRAPHICS TECHNICAL CHARTING



TECHNICAL GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Cricket Graph	ProPlot	Grapher	EasyPlot	Tech*Graph* Pad	GraFit	SlideWrite Plus	SDS	Axum
	\$129	\$169	\$189	\$349	\$395	\$430	\$445	\$450	\$495
GENERAL INFORMATION									
Interface type	Windows	Command line	Menu	Graphical	Menu	Windows	Graphical	Command line	Menu
Expanded memory support	■	■	■	■	■	■	□	■	■
Math coprocessor support	□	■	■	■	□	■	■	■	■
Mouse support	■	□	□	■	□	■	■	□	□
Batch or script language	□	■	□	■	■	□	□	■	■
TWO-DIMENSIONAL PLOTTING									
Scatter plot	■	■	■	■	■	■	■	□	■
X,Y plot	■	■	■	■	■	■	■	□	■
Line plot:									
Jointed	■	■	■	■	■	■	■	□	■
Smooth	■	■	■	■	■	■	■	□	■
Stepped	□	□	□	□	■	□	□	□	■
Hi-lo	□	□	■	□	□	■	■	□	■
Hi-lo-open-close	□	□	■	□	□	■	■	□	■
Polar plot	■	□	□	■	■	□	□	□	■
Maximum points per line	2,700	5,120	32,000	Unlimited	Unlimited	8,000	4,000	N/A	Unlimited
Maximum lines per graph	100	Unlimited	10	Unlimited	10	Unlimited	12	N/A	64
THREE-DIMENSIONAL PLOTTING									
Surface plot	□	□	□	■	□	□	□	□	■
Filled surface plot	□	□	□	□	□	□	□	□	■
Contour plot	□	□	□	■	□	□	□	■	■
Combination surface/contour plot	□	□	□	□	□	□	□	■	■
3-D scatter plot	□	□	□	■	□	□	□	□	■
Carpet plot	□	□	□	□	□	□	□	□	■
Rotates 3-D plots interactively	N/A	N/A	N/A	■	N/A	N/A	N/A	□	■
Maximum points per surface	N/A	N/A	N/A	Unlimited	N/A	N/A	N/A	2,200	15,625
PLOTTING OPTIONS									
Ignore missing observations	■	■	■	■	■	□	□	□	■
Extrapolation	□	□	■	■	■	■	□	□	■
Interpolation:									
Linear	■	■	■	■	■	■	□	□	■
Spline	□	■	■	■	■	□	□	□	■
Parametric	□	■	□	□	□	■	□	□	■
Error bars:									
From data	■	■	■	□	■	■	■	□	■
Plus/minus range	□	■	■	■	■	■	□	□	■
Standard deviation	■	■	■	□	□	■	■	□	■
Curve fitting:									
Linear	■	■	■	■	■	■	■	□	■
Polynomial (2nd order or higher)	■	■	■	■	■	■	■	□	■
Exponential	■	□	■	■	■	■	■	□	■
Logarithmic	■	□	■	■	■	■	■	□	■
Geometric	■	■	■	■	■	■	■	□	■
Hyperbolic	□	□	□	■	□	■	□	□	■
Fourier	□	□	□	□	□	■	□	□	□
Maximum number of independent variables	1	1	1	1	1	10	1	N/A	88
Plot math functions	□	■	□	■	■	■	■	□	■
Graph curve data as points	□	■	■	■	■	■	□	□	■
Save curve data to file	□	■	■	■	■	■	□	□	■
Display equation as annotation	■	■	■	■	■	□	■	□	■

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS TECHNICAL CHARTING

you must insert a z value into each column of the data definition string.

Click on the "three D" menu option once the data is appropriately defined, and *EasyPlot* will shift into a separate, wire-frame graphics mode. This mode offers several nice features, including the ability to animate axis rotation by a specified degree and direction until told otherwise. The three-dimensional module lacks the annotation and labeling capabilities you'd need to produce publication-quality graphs, but its capabilities are ample for visualization and for quick-and-dirty print-outs.

EasyPlot has a batch language that lets you execute any menu commands, plus a handful of others. This language lacks sufficient conditional statements and other commands to keep inveterate tinkerers busy for long, but it should prove a significant advantage to researchers who find themselves graphing similar data sets time and time again.

GETTING IT ON PAPER

EasyPlot's two-dimensional annotation features and its inclusion of numerous line and marker options offer welcome flexibility in labeling two-dimensional output. Its one notable deficit in this area concerns axis tick labels, which can be forced from fixed notation to exponential and vice versa only by changing a batch file parameter. If you want to produce a graph with tick values labeled in a specific format—two digits beyond the decimal point, for instance—you'll have to enter the tick values yourself.

The print routines include a no-frills preview feature. Printing is relatively fast



FACT FILE

EasyPlot, Version 2.0

Spiral Software, 6
Perry St., #2,
Brookline, MA
02146; 800-833-
1511, 617-739-
1511.

List Price: \$349

Requires: IBM XT, AT, or compatible; 512K
RAM; Hercules, EGA, or VGA graphics
adapter; DOS 2.0 or later. Mouse
recommended.

In Short: Good support for both 2D and 3D
plotting and a nice multiwindow interface at a
reasonable price should make this package a
good value, but the version we tested has too
many bugs to gain our recommendation.

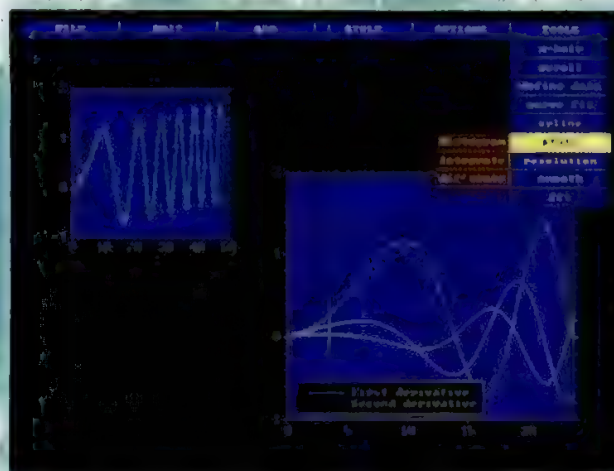
CIRCLE 407 ON READER SERVICE CARD



and of good quality. The program's monochrome PostScript routines had minor problems with the placement of annotations when we printed multiple graphs on one page, but single-chart jobs produced publication-quality results, thanks in part to the program's scalable Helvetica font. Support for additional scalable fonts would be a welcome improvement, however.

ROUGH EDGES, UTTER FAILURES

Despite its considerable utility and substantial promise, *EasyPlot* suffers from a few significant omissions. Though it can produce error bars for both the x- and y-axes, it can only do so if the percentage values are embedded in the data. And the package is lacking in all but the most elementary data-editing capabilities. Even when all columns are available, you cannot move or delete the columns or delete



EasyPlot's lightning-fast graphical interface lets you display several graphs on the screen at once in movable and resizable windows.

CONTINUES

GRAPHICS TECHNICAL CHARTING



TECHNICAL GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Cricket Graph	ProPlot	Grapher	EasyPlot	Tech*Graph* Pad	GraFit	SlideWrite Plus	SDS	Azum
BUSINESS AND TECHNICAL CHARTING									
Bar charts (vertical/horizontal):									
Unstacked	■ / ■	■ / ■	□ / □	■ / □	■ / □	□ / □	■ / ■	□ / □	■ / ■
Stacked	■ / ■	□ / □	□ / □	■ / □	□ / □	□ / □	■ / ■	□ / □	■ / ■
Maximum number of bars	40	Unlimited	N/A	Unlimited	500	N/A	400 vertical, 36 horizontal	N/A	Unlimited
Pie charts	■	□	□	□	□	□	■	□	■
Area charts	■	□	□	□	□	□	■	□	□
Combination charts:									
Line over bar	■	■	□	■	■	□	■	□	■
Can overlay any combination	□	■	■	■	■	□	■	□	■
Maximum number of overlays	N/A	Unlimited	Unlimited	Unlimited	Unlimited	N/A	400	N/A	Unlimited
Histograms:									
One variable	□	□	□	■	■	□	■	□	■
Two variables (3-D)	□	□	□	□	□	□	□	□	■
DATA HANDLING									
Data files (import/export):									
ASCII (space-delimited)	□ / □	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / □	■ / ■	■ / ■
ASCII (comma-delimited)	□ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / ■
ASCII (tab-delimited)	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □	■ / □
ASCII (print-image)	□ / □	■ / □	■ / □	■ / □	■ / □	□ / □	□ / □	□ / □	■ / ■
.DIF (Lotus)	■ / □	□ / □	□ / □	□ / □	□ / □	■ / □	□ / □	□ / □	□ / □
SYLK	■ / □	□ / □	□ / □	□ / □	□ / □	□ / □	□ / □	□ / □	□ / □
.WK1 (Lotus 1-2-3)	■ / □	■ / □	□ / □	■ / □	■ / □	□ / □	■ / □	□ / □	■ / □
Keyboard data entry	■	■	■	■	■	■	■	□	■
Per-chart maximums:									
Data points per series	2,700	5,120	32,000	Unlimited	32,000	8,000	4,000	2,200	Unlimited
Data series per chart	40	Unlimited	10	Unlimited	10	Unlimited	12	2,200	64
Data points per chart	108,000	Unlimited	64,000	Unlimited	320,000	Unlimited	4,000	2,200	Unlimited
Data sheet maximums:									
Total data points	108,000	Unlimited	64,000	5,000	Unlimited	1 million	4,000	N/A	Unlimited
Total data series	40	Unlimited	25	50	Unlimited	1,000	12	N/A	Unlimited
Floating-point precision (number of significant digits)	15	8	9	18	12	16	9	N/A	7
User-selectable	■	□	■	□	□	■	□	N/A	■
Coordinate systems:									
Rectangular (Cartesian)	■	■	■	■	■	■	■	■	■
Cylindrical	■	■	□	□	■	□	□	□	■
Spherical	□	□	□	□	□	□	□	□	□
Convert between coordinate systems	■	■	□	□	■	□	□	□	■
Selects noncontiguous data	■	■	□	■	■	■	□	□	■
Graphs named ranges	■	■	□	□	■	□	□	□	■
Ignores blank rows or columns	■	■	■	■	■	□	■	□	■
Live link to worksheet file	□	■	□	□	■	□	□	□	□
Paste link to worksheet (DDE)	□	N/A	□	N/A	N/A	N/A	N/A	N/A	N/A
DATA TRANSFORMATION FUNCTIONS									
Data sheet operations:									
Logical operators	■	■	□	□	■	■	□	□	■
Recoding functions	■	■	□	□	■	■	□	■	■
File-merging functions	□	■	□	■	■	■	■	□	□
Mathematical functions:									
Algebraic formulas	□	■	□	■	■	■	■	■	■
Symbolic functions	□	□	□	□	■	■	□	□	■
Trigonometric functions	■	■	□	■	■	■	■	□	■
Inverse trig functions	□	■	□	■	□	■	■	□	■
Hyperbolic trig functions	□	■	■	■	□	□	■	□	■
Natural logarithms	■	■	□	■	■	■	■	□	■
Base 10 logarithms	■	■	□	■	■	■	■	□	■

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS TECHNICAL CHARTING

a range of rows, and since the program insists on interpreting any row of data that begins with a text character as a comment, if the first column of your worksheet file contains text, the program will simply decline to graph the remaining columns.

EasyPlot also suffers from numerous glitches, some of them serious. Some relatively innocuous bugs we discovered resulted in tick labels that disappeared for no apparent reason; a deleted legend that chose to dodge about between multiple graphs, reappearing at the least convenient times; and manually drawn annotation lines that didn't realize they were not included in the zoom box and consequently invaded other portions of the screen at larger-than-life sizes. And more serious bugs caused the program to crash no less than ten times during our testing.

Spiral Software seems genuinely dedicated to supporting the product and promises that an interim release, which should be available by the time you read this, will fix these bugs. But locating and eliminating all of the problems in so short a time should prove no easy task, and in the meantime those who have bought the package for \$349 will find themselves functioning effectively as beta testers. The program's speed and mathematical flexibility are important strengths, but until its vendor takes care of all the glitches, you'd be wise to hold on to your money.

GraFit

by Barry Simon

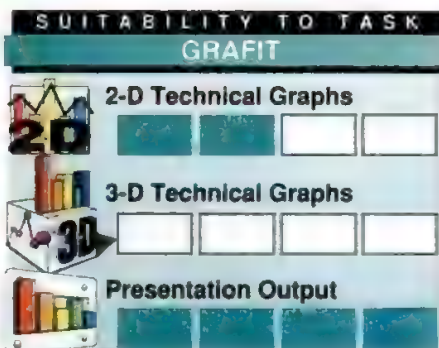
GraFit is the odd one out in this roundup. First, this \$430 program from Erithacus Software runs under *Microsoft Windows* (we reviewed the *Windows 2.x* version; a true *Windows 3.0* version that has similar features but uses the Multiple Document Interface is expected to supersede it by the time you read this). And second, it concentrates on a single purpose rather than trying to provide all the graphical tools to all technical users.

As the funny capital in its name indicates, *GraFit*'s sole objective is to show best-fit curves on experimental data. You won't find pie or bar charts here, not even histograms. But you will find general least-squares nonlinear regressions for any function you can define using algebraic, exponential, trigonometric, or step functions.

The current version will handle regressions with one, two, or three independent variables. However, since the program displays nothing but curves, you are limited to displaying only cross sections of the fits for two or three independent variables; *GraFit* displays neither surfaces nor contours.

IMPORTANT DATA

You begin by getting data into the program's spreadsheet-like data table. In



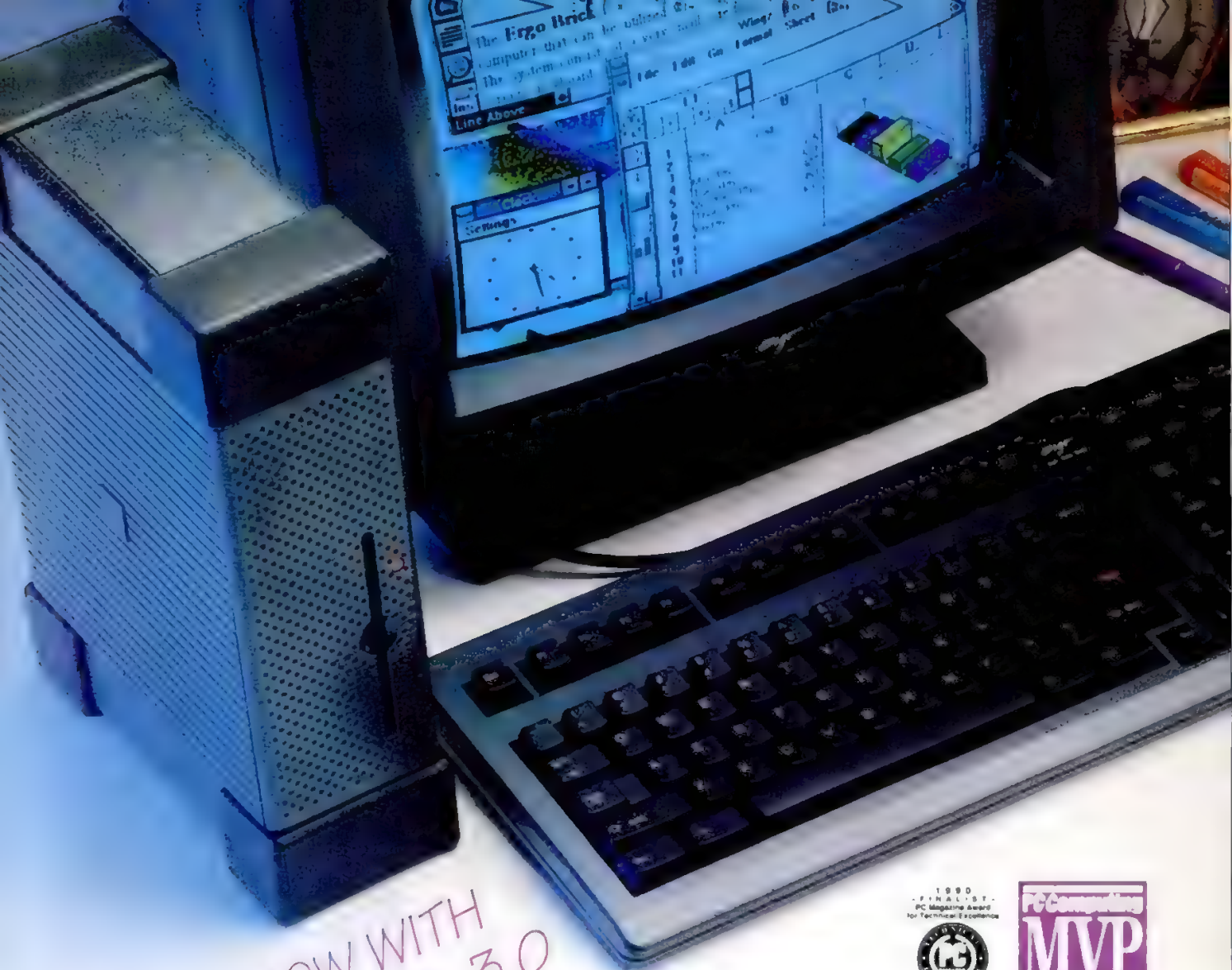
addition to the more common data formats, ASCII and .DIF, the product imports the PECSS files produced by Perkin Elmer spectrophotometers and the .BSF files produced by several Beckmann Instruments devices. However, it does not let you import Lotus worksheet (.WK1) files, and its tab-delimited ASCII file import function did not handle missing values well.

The program's data spreadsheet has 8,000 rows, and data is fitted columnwise. Only memory limits the number of columns in your data sheet. You can form new columns from old ones by applying fairly general functions, but multicolumn operations are limited to addition and subtraction.

Once you have the data imported, you need to specify the equation you want to fit. If you have a single dependent variable, the process is quite flexible: You simply specify an equation with some number of unknown parameters. Moreover, any of these equations can be saved in libraries. Included with the product are equations for ligand binding, enzyme kinetics, and radioimmunoassays.

Having specified the data and equations, a single menu choice runs the curve fit algorithm, which was always quite speedy on my 25-MHz 386 with math coprocessor. A report window tells you the parameters and lists the data points next to those calculated in the fit. Another

CONTINUES



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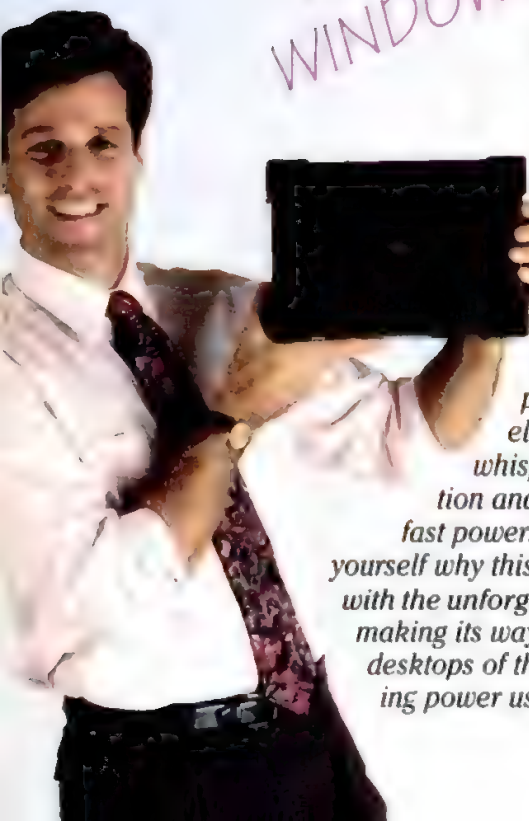


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Ergo Computing Inc.



THE BRICK™

Designed for the Way you Always Wanted to do Computing



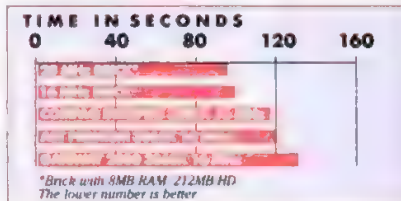
Customers and critics alike are praising the Brick for its portability, elegant design, whisper quiet operation and screamingly fast power. Find out for yourself why this diminutive PC with the unforgettable name is making its way onto the desktops of the most demanding power users.

More Practical Than a Portable

For multisite computing, the Brick offers an alternative to the usual trade-offs of laptops or multiple PC's. Just keep your preferred keyboard and full size monitor, plus power supply at your regular destination and carry only the 8 lb. Brick in between. You'll save half the cost, half the weight and all the hassle of coordinating files between multiple machines.

Blazingly Fast

Compared to published reports of all 386SX machines tested to date by PC Magazine, the Brick offers superior performance on the aggregate of



Time to complete PC Magazine's full benchmark test set.

BRICK & WINDOWS SPECIAL

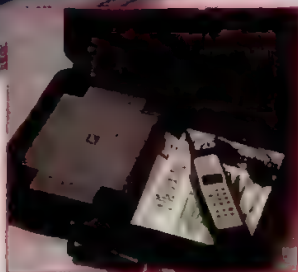
\$2,495

Windows 3.0
with the hottest Windows add-ons
4MB of RAM
44MB Hard Disk
2,400bps Modem
1024 x 768 VGA Graphics
Adobe's ATM
QEMM 5.1
Logitech Mouse

SAVE \$881

"The Brick is... a great personal computer in every respect. It takes up minimal desk space, it's both rugged and stylish, and it's extremely fast."

Bill Machrone, PC Magazine, 1/91



Fits in half a briefcase, leaving room for full-sized folders, notebooks, etc.

system, video and hard disk benchmarks.

Massive Hard Disk

Bricks are available with 16 or 20 MHz 386SX, 1-8 MB of RAM, a fast 44, 104 or 212 MB Conner or Teac IDE hard disk, and a 387 coprocessor socket. A 2,400 bps Hayes compatible modem is standard.

"A whole new slant on portable computing... exceptionally ingenious."

Portable Office
12/90, Eric Grevstad

"Recommended."

Jerry Pourmelle Byte, 1/91,

The fast VGA graphics feature up to 1024 x 768 non interlaced resolution with a full 1 MB of video memory. In fact, the Brick's video performance is twice as

fast as the average of 42 386SX systems tested to date by PC Magazine!

Surprisingly Expandable

The Brick is only about the size of a ream of copier paper, yet you can still add up to two ISA half cards internally, (one card with a floppy drive). A docking

"A Tote-able That Outperforms the Desktops."
PC Magazine
9/90, Matt Ross



port allows easy, drop-in connection to our Docking Terminal, \$349, which instantly hooks up all cables and provides another 16-bit 3/4 length slot. The "Stretch" version of the Brick accommodates full length cards.

Brick & Windows Hot Special

It takes more than just software and a mouse to make a satisfying Windows

machine. Our Brick & Windows Special comes with 4MB of RAM (not 2 as others provide), Windows 3.0, DOS, and a

Logitech mouse with our hot 16 MHz 386SX Brick. You also get two award winning programs that are essential to fulfilling the promise of Windows. Adobe's wonderful Type Manager (ATM) with 13 fonts for true WYSIWYG display and high quality printed documents and Quarterdeck's QEMM 5.1 memory manager for running Windows on a network.

No other 386SX matches the Brick's graphics processing power, storage capacity, quietness and versatility. And while others give you Windows, we give you what it takes to make Windows 3.0 really perform.

\$2,495

Brick & Windows Special includes:

- ▲ 16 MHz Intel 386SX
- ▲ 4MB RAM
- ▲ 44MB 28ms hard disk
- ▲ 1024 x 768 VGA adapter
- ▲ 2,400 bps modem
- ▲ 3.5" floppy
- ▲ 16-bit half card exp. slot
- ▲ 1 parallel, 2 serial ports
- ▲ Windows 3.0 and DOS
- ▲ QEMM 5.1
- ▲ Adobe Type Manager
- ▲ Logitech Mouse
- ▲ All software completely set up. Ready to go.

Options:

- ▲ 104MB add \$395
- ▲ 212MB add \$995
- ▲ 20MHz Brick add \$250
- ▲ 8MB RAM add \$396
- ▲ 12" mono VGA monitor & 101 keyboard add \$218
- ▲ 14" color VGA 640 x 480 monitor & 101 keyboard add \$464
- ▲ Freight prepaid.

Save \$881 off 1990 catalogue prices
Offer expires 5/31/91

GRAPHICS TECHNICAL CHARTING



TECHNICAL GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Cricket Graph	ProPlot	Grapher	EasyPlot	Tech*Graph* Pad	Gr*Fit	SlideWrite Plus	SDS	Axum
DATA TRANSFORMATION FUNCTIONS									
Combinatorics	☐	☐	☐	☐	☐	☐	☐	☐	☐
Factorials	☐	☐	☐	☐	☐	☐	☐	☐	☐
Error functions	☐	☐	☐	☐	☐	☐	☐	☐	☐
Gamma functions	☐	☐	☐	☐	☐	☐	☐	☐	☐
Bessel functions	☐	☐	☐	☐	☐	☐	☐	☐	☐
Polarity functions	☐	☐	☐	☐	☐	☐	☐	☐	☐
Fourier transforms	☐	☐	☐	☐	☐	☐	☐	☐	☐
Data-smoothing functions:									
Weighted (based on variance)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Uniform	☐	☐	☐	☐	☐	☐	☐	☐	☐
Parametric	☐	☐	☐	☐	☐	☐	☐	☐	☐
DATA REPORTING FUNCTIONS									
Summary statistics:									
MinMax	☐	☐	☐	☐	☐	☐	☐	☐	☐
Sum	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mean	☐	☐	☐	☐	☐	☐	☐	☐	☐
Median	☐	☐	☐	☐	☐	☐	☐	☐	☐
Mode	☐	☐	☐	☐	☐	☐	☐	☐	☐
Variance	☐	☐	☐	☐	☐	☐	☐	☐	☐
Save summary statistics as data	☐	☐	☐	☐	☐	☐	☐	☐	☐
Correlation coefficient	☐	☐	☐	☐	☐	☐	☐	☐	☐
Regression coefficients	☐	☐	☐	☐	☐	☐	☐	☐	☐
Save error series as data	☐	☐	N/A	☐	☐	☐	☐	N/A	☐
Goodness-of-fit tests:									
R2	☐	☐	☐	☐	☐	☐	☐	☐	☐
t-stat	☐	☐	☐	☐	☐	☐	☐	☐	☐
F-stat	☐	☐	☐	☐	☐	☐	☐	☐	☐
View selected graph values	☐	☐	☐	☐	☐	☐	☐	☐	☐
View range of graph values	☐	☐	☐	☐	☐	☐	☐	☐	☐
AXIS AND SCALING OPTIONS									
Axis options:									
Right y	☐	☐	☐	☐	☐	☐	☐	☐	☐
Top x	☐	☐	☐	☐	☐	☐	☐	☐	☐
Double y	☐	☐	☐	☐	☐	☐	☐	☐	☐
Double x	☐	☐	☐	☐	☐	☐	☐	☐	☐
Multiple scales on one axis	☐	☐	☐	☐	☐	☐	☐	☐	☐
Scale axis by number of values	☐	☐	☐	☐	☐	☐	☐	☐	☐
Scaling options:									
Semi-log (y-axis)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Semi-log (x-axis)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Log-log	☐	☐	☐	☐	☐	☐	☐	☐	☐
Base 10 logs	☐	☐	☐	☐	☐	☐	☐	☐	☐
Natural logs	☐	☐	☐	☐	☐	☐	☐	☐	☐
Probabilistic scaling	☐	☐	☐	☐	☐	☐	☐	☐	☐
Grid lines:									
Show grid lines	☐	☐	☐	☐	☐	☐	☐	☐	☐
Vertical or horizontal lines only	☐	☐	☐	☐	☐	☐	☐	☐	☐
Background grid on 3-D charts	☐	☐	☐	☐	☐	☐	☐	☐	☐

☐—Editors' Choice ☒—Yes ☐—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS TECHNICAL CHARTING

menu choice then plots the data points and the best-fit curve.

MENUS MADE EASY

That's when the fun begins, because *GraFit* makes excellent use of the *Windows* interface to allow easy customization of the graph. Other programs would do well to study *GraFit*'s user interface because it is so pleasant. Want to change the marker for a curve? Simply double-click on the marker in the legend and a dialog box in which you can choose a new marker, set error bars, or change colors pops up. Other aspects of the graph are just as easy to customize.

Since the graph is object-oriented, you can resize or move it by pulling on handles or on the graph as a whole. You can also manipulate several graphs as either transparent or opaque objects, one in front of another. While *GraFit* itself does not contain clip art, it lets you paste in line art (*Windows* metafiles) from the *Windows* Clipboard. No drawing tools come with the program.

For fonts and drivers, the program depends on *Windows*—which is good because of the variety of fonts and drivers available on the market but bad because of some limitations. *GraFit* uses *Windows* font handling to print the text segments of its graphs, so while you can get high-class printed output, you're also limited by the text-handling capabilities of the printer. For example, with an HP LaserJet, you cannot print fonts in both orientations on one page.

While the handling of data with a single *x,y* pair is well done, much beyond that is awkward, often depending on tricks



FACT FILE

GraFit

Erithacus Software Ltd., P.O. Box 35, Staines, Middlesex, TW18 2TG, United Kingdom; (011-44) 784-463-4672.

List Price: \$430

Requires: IBM AT or compatible, 640K RAM (1MB recommended); graphics adapter, DOS 3.0 or later, *Microsoft Windows* 2.1 or 3.0.

In Short: *GraFit*'s strength lies in fitting data with one dependent and one independent variable; doing much beyond that often relies on cobbling tricks together. The interface is particularly user friendly, though, making the program a pleasure to use.

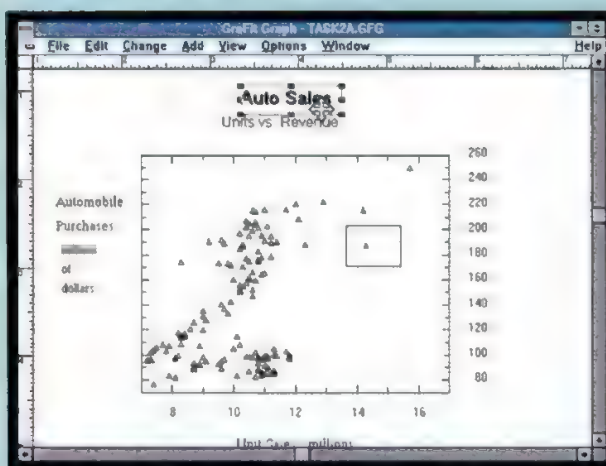


CIRCLE 408 ON READER SERVICE CARD

cobbled together. If you want to fit several *y* variables that have parameters in common (for example, if they are to be fitted with straight lines that have the same slope but different intercepts), the manual describes a method that requires several copies of data columns, merges, and the use of multiple *x* parameters. Or, to have different axes on the left- and right-hand sides of a graph, the recommended procedure is to make two separate graphs and paste one on top of the other.

BOTHERSOME BUGS

In our tests, we came across a number of bothersome although not fatal bugs. Text that appeared unclipped on screen could be clipped when printing if the text box wasn't wide enough. We were unable to use the Save As command with graphs without the program exiting with an Unexpected Application Error message from *Windows*.



GraFit uses an involved dialog to set up equations to be fitted. A single menu choice runs the curve-fit algorithm from the specified data and equation.

CONTINUES

GRAPHICS TECHNICAL CHARTING



TECHNICAL GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Cricket Graph	ProPlot	Grapher	EasyPlot	Tech*Graph* Pad	GraFit	SlideWrite Plus	SDS	Axum
GRAPH FORMATTING OPTIONS									
Labels and legends:									
Pick up labels from worksheet	■	■	■	■	□	□	■	□	■
Calculate data labels	■	■	■	■	■	□	■	■	■
Calculate data percentages	■	□	■	□	□	□	■	□	■
Automatic time series labeling	□	□	□	□	□	□	□	□	□
Edit text directly on chart	□	□	■	■	□	■	■	□	■
Resize legends	■	■	■	□	■	■	■	□	■
Chart rotation and resizing:									
Rotate chart or graph	□	■	■	■	■	□	■	■	■
View cross-section	□	□	□	□	□	□	□	□	■
Resize chart or graph	■	■	■	■	■	■	■	■	■
Preserve aspect ratio when resizing	■	■	■	■	■	□	■	■	■
Line and point styles:									
Number of line styles	4	Unlimited	2	7	10	6	12	2	9
Number of point symbols	16	700	57	14	10	13	12	1	16
Fill patterns:									
Number of fill patterns	7	32	None	14	None	None	21	8	148
Use bitmap fill patterns	□	□	N/A	□	N/A	N/A	■	□	□
Import fill patterns	□	□	N/A	□	N/A	N/A	□	□	□
Colors:									
Maximum number of colors per chart	256	1	16	8	8	16.7 million	16	16	16
Pick colors from palette	■	□	■	□	□	■	□	□	■
Pick colors by name or number	□	□	■	■	■	□	■	■	■
Custom color palettes	■	□	□	□	□	■	■	■	□
Gradient backgrounds	□	■	□	□	□	■	■	□	□
ANNOTATION									
Drawing and annotation tools:									
Line	■	■	■	■	□	□	■	□	■
Polyline	□	□	■	■	□	□	■	□	■
Arrow	■	■	■	■	■	□	■	□	■
Rectangle	■	■	■	□	□	■	■	□	■
Rounded rectangle	■	□	□	□	□	□	■	□	□
Arc	□	□	□	□	□	□	■	□	■
Circle/ellipse	□	□	□	□	□	□	■	□	■
Freehand curve	□	□	□	□	□	□	■	□	□
Image manipulation tools:									
Align to baseline	□	■	□	□	□	□	■	□	■
Cut/copy/paste objects	□	□	■	□	□	■	■	□	□
Duplicate objects	□	□	□	□	□	□	■	□	■
Group/ungroup elements	□	□	□	□	□	□	■	□	□
Rotate objects	□	□	■	■	■	□	■	□	■
Workspace control tools:									
Redraw	■	□	■	■	■	□	■	□	■
Zoom	□	□	■	■	■	■	■	□	■
Pan	□	□	■	■	□	■	■	□	□
Multiple graphs on screen	■	□	□	■	□	■	■	□	■
Import graphics (formats)	.WMF	None	None	None	.PIC	.WMF	CGM, .PCX, TIFF	None	None
TEXT HANDLING									
Native fonts:									
Supports built-in scalable fonts	■	■	■	■	■	■	■	□	■
Number of typefaces supplied	10	2	16	1	1	None	20	None	21
Greek characters	■	■	■	■	■	■	■	□	■
Scientific symbols	■	■	■	■	■	■	■	□	■

■—Editors' Choice ■—Yes □—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS TECHNICAL CHARTING

GraFit isn't as powerful as some of its competitors, and it could stand improvement in a number of areas. But if your main interest is in curve fitting and you need good-looking output, it's a program you'll want to have.



3-D Visions' \$495 *Graftool* is a powerful tool for graphing and analyzing data. It will produce just about any graph type known to man on-screen or on paper and let you customize it with ease.

You can bring data into the program in three ways. First, you can import it from ASCII files or .WK1 spreadsheets. Literally millions of points are allowed. The .WK1 import does not allow you to specify a named range, although once you import the file into *Graftool*'s data table, you can easily remove unwanted rows or columns.

The second way to get data into the program involves the 4,096 by 4,096 data table that *Graftool* calls a worksheet. It won't replace your spreadsheet, but it has more power than the data tables in most graphing programs and includes the ability to swap, move, copy, or delete rows and columns, to compute mean and standard deviation of a specified range, transpose rows and columns, or to do transformations between coordinate systems.

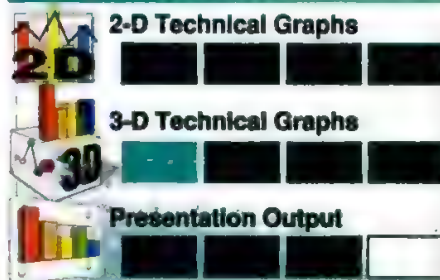
The third data input has you enter the equation for a curve or surface and then let *Graftool* fill out the data table, evaluating the function over a user-specifiable grid

of values. Functional building blocks here and in the worksheet include not only the standard algebraic, trigonometric, and exponential/logarithmic functions but also Bessel, error functions, and conditional IF statements.

SOPHISTICATED TOOLS

Once you have data and have saved it out to disk, you can choose from 14 different graph types that can be used to produce even more types. Included in the basic 14 types are not only bar, pie, x,y plots and

SUITABILITY TO TASK GRAFTOOL



histograms, but also polar, surface, and contour plots. You can combine graph types to render combination, surface, and projected contours or to make mixed bar and line graphs.

There are numerous options for changing a graph: You can add text boxes, legends, and axis labels. You can shift to log or semilog scale and add error bars or arrows. You cannot import clip art, nor are there any drawing tools. One of the program's weak points is text handling. You can have only one type of font per graph, and you can choose from only three supplied fonts: Times, Helvetica, and



Graftool's state-of-the-art graphical interface is a door into its powerful 3-D manipulation features. A palette of icons makes it easy to choose frequently used menu items.

CONTINUES

Shelling out an extra \$10,000 for a Compaq SystemPro with chancey service is appalling. With that kind of iffy support, they should be paying you the ten grand.

On the other hand, Dell's i486™ servers come with the same service that's won an unprecedented 8 PC Week Corporate Satisfaction Polls for PCs, laptops and servers.

Spend less. Get more. Sounds better, doesn't it?

We have two new i486 EISA servers.

Dell gives you a choice of the 25 MHz Dell® 425TE and the 33 MHz Dell 433TE.

The 25 MHz Dell System® 425TE has up to 64 MB of RAM capacity, 11 storage bays, and a

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whisper-
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supply. We've also built in features such as password protection, a software controlled reset switch, and an efficient cooling system to protect component life.

What's more, both the 433TE and the 425TE have the Dell designed SmartVu™ diagnostic display built in. This ingenious innovation helps identify problems even if the monitor goes down.

For even more performance, the 33 MHz Dell System 433TE is everything our 425TE is, with 32% more speed. The Dell exclusive memory design with a 128 KB external cache gives it maximum throughput.

APPEALING.



\$12,199

Dell System 433TE

Lease: \$438/mo.

\$9,999

Dell System 425TE

Lease: \$359/mo.

THE NEW DELL SYSTEM 433TE 33 MHz EISA i486 AND 425TE 25 MHz EISA i486.

Standard features:

- Intel® i486 microprocessor running at 33 MHz (433TE) or 25 MHz (425TE) with 8 KB internal cache.
- 128 KB external cache (433TE)
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- Socket for WEITEK 4167 math coprocessor.
- 11 internal half-height drive bays.
- Eight 32-bit EISA expansion slots (six EISA master slots and two EISA slave slots)
- High-performance IDE (80 MB, 100 MB, 190 MB) and ESDI (330 MB, 650 MB) hard disk drives.

650 MB VGA Color Plus System
Using 4 MB SIMMS

433TE	425TE
\$12,199	\$9,999

Prices listed include 8 MB of RAM.

AD CODE 118D8



APPALLING.

\$24,698

Compaq SystemPro 486/33
Comparably configured.



■ **From this foundation, create a powerful PC network or UNIX® workgroup.** Dell's new systems have more than enough performance to function as a LAN Server and WAN or internetworking gateway. So they're capable of supporting

The Dell System 433TE and 425TE are Class A devices sold for use in commercial environments only. Performance Enhancements: Within the first megabyte of memory 384 KB is reserved for use by the system to enhance performance. All Dell systems are photographed with optional extras. All prices and specifications are subject to change without notice. Dell cannot be responsible for errors in typography or photography. *Payment based on 36-month, open-end lease. †Leasing arranged by Leasing Group, Inc. In Canada, configurations and prices may vary. Dell and DELL SYSTEM are registered trademarks and SmartVu is a trademark of Dell Computer Corporation. Intel is a registered trademark and 486 and 486 are trademarks of Intel Corporation. UNIX is a registered trademark of AT&T in the United States and other countries. Other trademarks and trade names are used to identify the entities claiming the marks and names of their products. Dell Computer Corporation disclaims any proprietary interest in trademarks and trade names other than its own. ††From Compaq July 23, 1990 press release. ‡Xerox on-site service may not be available in certain locations. Shipping, handling and applicable sales tax not included in the price. For information on and a copy of Dell's 30-day Total Satisfaction Guarantee, limited warranty, and Xerox's Service Contract, please write to Dell USA Corporation, 9505 Arboretum Boulevard, Austin, Texas 78759-7299, ATTN: Warranty. ©1991 Dell Computer Corporation. All rights reserved.

the most demanding server use—a multi-function network. Of course, they're completely compatible with all major network operating systems, including Novell, 3COM, Banyan and LAN Manager.

The 425TE and 433TE are perfect for UNIX® workgroups, supporting either character-based, multi-user or graphical-based client/server environments. You can buy Dell servers preloaded with UNIX System V, making them literally plug and play. Even more impressive is the fact that UNIX system administration can be done by Dell, remotely.

Maintaining servers can be beyond most computer repairmen. If a server goes down, your whole company can go down with it.

Would you trust some unknown technician to bring it back up? We wouldn't.

That's why we have a special advanced systems hotline so you can call us direct. Dell is an AT&T UNIX source code licensee and an authorized Novell Network Reseller.

On those rare occasions we can't fix it over the phone, Xerox® technicians will come to your office with the solution in hand.

There's a lot to know before you buy a server.

When you call Dell, our experts will give you the help you need to buy an advanced PC or UNIX server. Then we'll send it off with a 30-day no questions asked money back guarantee, and a one year limited warranty.

So call us. Unless you find appalling appealing.



GRAPHICS TECHNICAL CHARTING



TECHNICAL GRAPHICS: SUMMARY OF FEATURES

Products listed in ascending price order

	Cricket Graph	ProPlot	Grapher	EasyPlot	Tech*Graph* Pad	GraFit	SlideWrite Plus	SDS	PC Axum
TEXT HANDLING									
Printer font support:									
HP LaserJet cartridge fonts	☐	☐	☐	☐	☐	☒	☒	☐	☐
HP LaserJet soft fonts	☐	☐	☐	☐	☐	☒	☒	☐	☐
PostScript fonts	☐	☒	☐	☒	☒	☒	☒	☒	☒
Text entry options:									
Text editor	☒	☐	☒	☐	☒	☒	☒	☐	☐
Word-wrap text frames	☒	☐	☐	☐	☐	☒	☐	☐	☐
Shrink text to fit box	☐	☒	☐	☐	☐	☐	☒	☐	☒
Text alignment options:									
Align text	☒	☒	☒	☐	☒	☒	☒	☐	☒
Indent text	☐	☒	☐	☐	☐	☐	☐	☐	☐
Justify text	☒	☒	☐	☐	☐	☐	☒	☐	☐
Rotate text	☒	☒	☒	☐	☒	☒	☒	☐	☒
Kerning control	☐	☐	☐	☒	☐	☐	☒	☐	☒
Leading control	☐	☒	☐	☒	☐	☐	☐	☐	☒
Word charts:									
Formatted lists	☐	☒	☐	☐	☐	☐	☒	☐	☒
Multicolumn tables	☐	☒	☒	☐	☐	☐	☒	☐	☐
Spell-checker	☐	☐	☐	☐	☐	☐	☐	☐	☐
OUTPUT OPTIONS AND DEVICES									
Output options:									
Print preview	☐	☒	☒	☒	☒	☐	☒	☒	☒
Maximum graphs per page	10	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	400	Unlimited	Unlimited
Print to file	☒	☒	☒	☒	☒	☒	☒	☒	☒
Monochrome output devices:									
Epson 9-pin	☒	☒	☒	☒	☒	☒	☒	☒	☒
Epson 24-pin	☒	☒	☒	☒	☒	☒	☒	☒	☒
IBM Proprinter	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hewlett-Packard DeskJet	☒	☒	☒	☒	☒	☒	☒	☒	☒
Hewlett-Packard LaserJet	☒	☒	☒	☒	☒	☒	☒	☒	☒
PostScript	☒	☒	☒	☒	☒	☒	☒	☒	☒
Color output devices:									
Hewlett-Packard PaintJet	☒	☐	☒	☒	☒	☒	☒	☒	☒
Hewlett-Packard Plotters	☒	☐	☒	☒	☒	☒	☒	☒	☒
Film recorders	☒	☐	☐	☐	☐	☐	☒	☒	☐
Color PostScript	☒	☐	☐	☒	☐	☒	☒	☐	☐
Graphics file output:									
CGM	☒	☐	☐	☐	☐	☐	☒	☒	☐
.DXF	☐	☐	☒	☐	☐	☐	☐	☒	☐
EPS	☐	☒	☐	☒	☒	☒	☒	☐	☒
.GEM	☐	☐	☐	☐	☐	☐	☐	☐	☒
HPGL	☐	☐	☒	☒	☒	☒	☒	☒	☒
Lotus .PIC	☐	☐	☒	☐	☒	☐	☐	☐	☒
.WMF	☐	☐	☐	☐	☐	☐	☐	☐	☐
VIDEO SUPPORT									
Drivers:									
Hercules	☒	☒	☒	☒	☒	☒	☒	☒	☒
EGA (640 by 350)	☒	☒	☒	☒	☒	☒	☒	☒	☒
VGA (640 by 480)	☒	☒	☒	☒	☒	☒	☒	☒	☒
Super VGA (800 by 600)	☒	☐	☐	☐	☐	☒	☐	☒	☒
Extended VGA (1,024 by 768)	☒	☐	☐	☐	☐	☒	☐	☒	☒
8514/A	☒	☐	☐	☐	☐	☒	☐	☒	☐
TIGA	☒	☐	☐	☐	☐	☒	☐	☒	☐
Maximum colors on screen:									
Undithered	16.7 million	1	16	16	8	16.7 million	16	16	16
Dithered	16.7 million	1	16	16	8	16.7 million	16	16	125

☒—Editors' Choice ☒—Yes ☐—No

N/A—Not applicable: The product does not have this feature.

GRAPHICS TECHNICAL CHARTING

Simplex, with no support for standard outline fonts, cartridge fonts, or PostScript fonts. Both a standard ASCII and a Greek/symbol set is included for each font. However, be warned that the default setup is not WYSIWYG on text, using Helvetica for printer and the speedier Simplex for screen. Until I changed the options, I had some unpleasant surprises in which labels that looked close but distinct on the screen overlapped when printed out. Once I did change the options, this problem went away.

You can overlay plots on one another, and plots and text boxes may be treated as individual objects that can be separated, resized, positioned, and rotated. You can even rotate two-dimensional plots in three dimensions to get interesting text effects.

Besides letting you enter data and make simple functional transformations on it, *Graftool* has a variety of sophisticated data tools. It comes with six kinds of regression curves including linear, exponential, and sums of cosines. Load a 2-D data file and *Graftool* will do the regression you choose, reporting statistical information including correlation coefficients and the values of the free coefficients in the regression. *Graftool* will also do spline and parametric interpolations and three kinds of data smoothing.

Graftool allows you to specify curves as solutions of several functional relationships; in particular, it can do two- and three-dimensional parametric plots. Multiple levels of zoom linked with replotting from data after zoom allow details that

might not be visible at the upper level because of finite screen resolution to become visible once they're zoomed.

Graftool supports a wide variety of printers and plotters, including color PostScript. It runs in a proprietary graphical interface with support only up to VGA resolution.

SLOW PRINT TIMES

One of *Graftool*'s biggest weaknesses concerns the time it takes to draw and

Graftool's user interface is slick, with only a few awkward spots.

print. After changing options or moving objects, you explicitly have to ask to redraw the plot if you want to see the changes. On my 386/25, redraw times on complex three-dimensional graphs could take several minutes, and even simple graphs had noticeable redraw times. Printing is even slower, at least to my HP LaserJet III. The simplest graphs took 3 to 5 minutes. Printing a surface based on a 1,000-point data set took over an hour. The final output is impressive, but you had better plan to print over lunch or while you are off at a meeting!

Graftool has no on-line help other than a one-line explication of some menu items and dialog boxes that appear in a status area. The manual is clearly written, but the program does so much that it is occasionally difficult to find the information you need.

Graftool's user interface is slick, with only a few awkward spots. Users of earlier versions, even 3.0, will notice real improvements in the new interface in Version 3.3. Its menu area and dialog boxes have the 3-D look of *Windows* 3.0, with option buttons that look raised, which you depress. It has mouse support that lets you choose colors or symbols by pointing and clicking in a dialog box.

When you choose an object, handles appear around it—that is, bright squares in the corners and centers of the sides. Pulling on the center handles lets you move the object with your mouse, and



Graftool

SigmaPlot

Surfer

☐	☒	☐
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16	16	16

ENDS

FACT FILE EDITORS' CHOICE

**Graftool,
Version 3.3**

3-D Visions, 412 S.
Pacific Coast Hwy.,
2nd floor, Redondo
Beach, CA, 90277;
800-729-4723, 213-
540-8818.

List Price: \$495

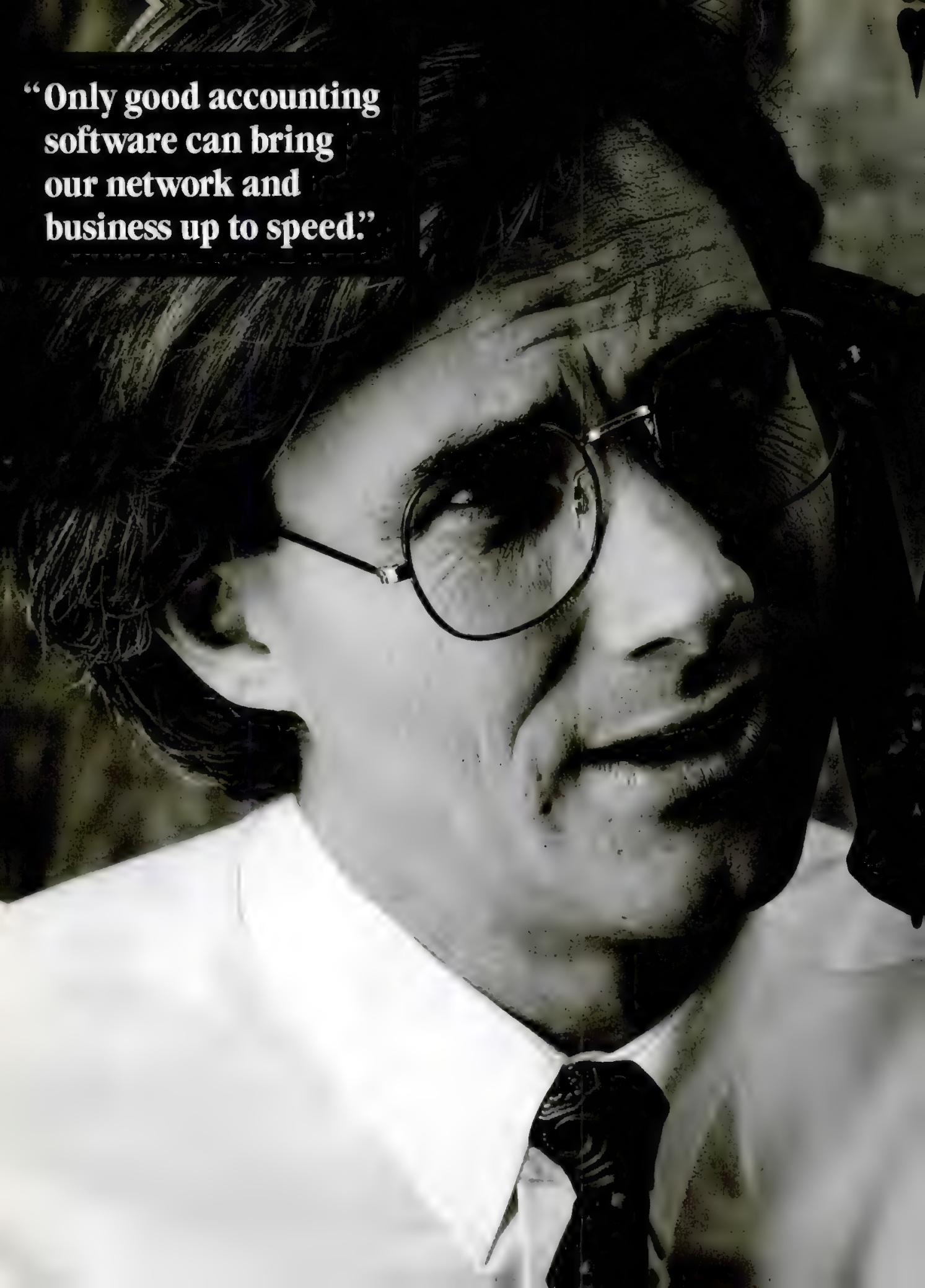
Requires: IBM XT, AT, or compatible; 640K
RAM, graphics adapter, DOS 3.0 or later.
Math coprocessor recommended.

In Short: Versatility and power combine to
make *Graftool* a program that scientists and
other technical junkies will covet. It can
produce just about any graph, handles data
sets of just about any complexity, and offers
powerful analysis features and attractive
output. Printing times are glacial, however.



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Keyboard	Standard AT-compatible 3mm key travel depth	Enhanced keyboard 2.5mm key travel depth
Memory	1MB expandable to 5MB	2 MB expandable to 10MB
Software Incl.	Laplink III MS-DOS Windows 3.0	Not available
Support	Toll-free 800 number On-line modem support	Not available
Price	20MB - \$3999 40MB - \$4499	30MB - \$6499 60MB - \$6999

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pulling on the corners lets you resize it. For anyone who has used scroll bars, panning zoomed graphs will feel very awkward.

Graftool is a package that many scientists will covet. If you can cope with its glacial printing and limited font support, it is an extremely flexible, powerful, and easy-to-use instrument.

Grapher

by Richard Hale Shaw

Golden Software's *Grapher* is the epitome of single-minded software: It does one thing. For your \$199, you won't get 3-D capabilities, bar graphs, or data transformation functions. What you will get is a dependable but unremarkable plotting package.

Grapher's design philosophy is a simple one: Create your data in a spreadsheet program, and then import it into *Grapher* using one of the ASCII file formats that the program supports (either space-, comma-, or tab-delimited ASCII); the program cannot import .XLS or .WK1 files. Just make sure that you do any data transformation before export, because *Grapher* has no data transformation capabilities.

What *Grapher* can do is create scatter plots, x,y graphs, and a variety of line plots and graphs. The only error bars allowed are the high-low-open-close variety that are found in stock charts; you cannot use calculated standard deviations when processing error bar plotting, however. You cannot create 3-D graphs or contours with *Grapher*, but you can overlay up to ten different graphs with different pen (and color) settings and symbols, using data from the same or different data files. In addition, *Grapher* includes a simple worksheet for viewing and editing your data tables.

Grapher also offers six curve-fitting functions: linear, cubic spline, exponential, logarithmic, power (which the documentation and program refer to as geometric), and polynomial. The latter offers an extra feature: You can preview the polynomial curve-fit statistics, including the sums of the squares of residuals and polynomial coefficients. You can also view Orthogonal Factors and Recursion Factors, and change the degree used. Unfortunately the program doesn't let you preview other curve-fitting statistics or

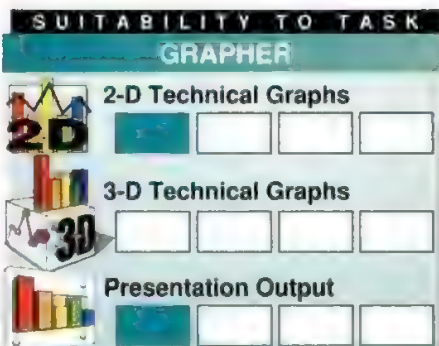
GRAPHICS TECHNICAL CHARTING

access the fitting statistics when more than one function is used.

EASILY MANIPULATED

Every aspect of *Grapher*'s graphs can be manipulated. You can control the symbols used, the axis, and the labels. Even the tic marks can be adjusted for shape, position, orientation, size, and color.

This flexibility is echoed in the program's modular design. The interactive



Grapher module can be used to create new graphs from a variety of sources, as well as manipulate the parameters of existing graphs, while the View module lets you display graphs stored on disk. View, a separate program that runs from the DOS prompt, lets you zoom and pan graphs, supply the x,y coordinates for elements like the location of a legend or title, and display more than one graph at a time.

When it comes to labeling, *Grapher* lets you choose from 24 different symbol sets, which can be scaled and manipulated. These symbol sets vary not only by point size and font but by content as well. While the standard symbol sets offer the

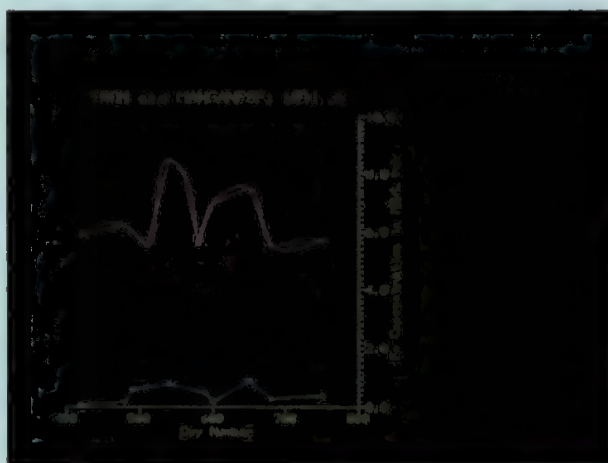
full English alphanumeric character set, there are subtle differences: You won't find a brace, percent sign, equal sign, underscore, or a tilde in every character set. This can be problematic if you use the same labels or legends with different character sets. Fortunately, *Grapher*'s ALTERSYM module lets you create your own character sets.

Once all the graphing has been done, it's time to turn to the Plot module, which produces hard copy and sends it to the printer or plotter. Like the View module, it can be run from the DOS prompt to print previously stored graphs or used from within *Grapher*. In addition to producing hard copy, Plot can create automated on-screen slide shows of graphs when run from a DOS .BAT file. Unfortunately, it doesn't offer any facility for determining line thickness when plotting to a laser printer, and its single-pixel-width lines are difficult to read.

READ FIRST, GRAPH LATER

You'll need to study *Grapher*'s manuals carefully to produce these graphs, though. The character-based menus are organized hierarchically and logically—a feature that scientific users will love—but the interface isn't particularly intuitive and can be intimidating for those whose thinking is less than scientific. It's difficult to build a graph and all its components as a single object, and you can easily find yourself juggling a pile of variables and graph characteristics without knowing exactly which graph you're working on.

Fortunately, the documentation includes an excellent tutorial that leads you step by step through the process of creating a graph. And if you get hopelessly lost



Grapher does basic 2-D plotting and curve-fitting (a cubic spline curve fit is shown here), but its output isn't much to look at.

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In a word, value.

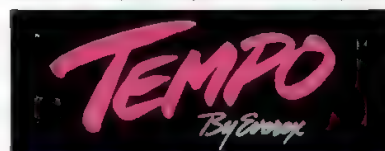
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FACT FILE

Grapher,

Version 1.79D

Golden Software,
809 14th St.,
Golden, CO 80401;
800-333-1021, 303-
279-1021.

List Price: \$199

Requires: IBM XT, AT, or compatible; 320K
RAM; DOS 2.0 or later. Graphics adapter
recommended.

In Short: This two-dimensional plotting
package doesn't offer many frills and its
interface could be improved, but it offers solid
performance at a reasonable price.



CIRCLE 410 ON READER SERVICE CARD

or are too impatient to work your way through the menus, you can always consult the menu map inside the front cover of each manual.

For those who find even the map too tough to follow, *Grapher* offers a novice mode. The device will warn you of any action that could mean a loss of data or plotting parameters and prompts you to save changes before exiting a menu. For those who feel more confident, there's an expert mode that simply alerts you to any potentially dangerous shortcuts.

Grapher has the basic functions a scientific user needs to create and manipulate two-dimensional graphs, and its cost is modest. But you'll find more features and better output among its competitors.

ProPlot

by David Kushner

ProPlot is an old-fashioned program that addresses a real-world need. A simple package with a modestly low price (\$169; \$79 for academic users), *ProPlot* produces only two-dimensional plots in black and white. But with a PostScript printer, you can get publication-quality output.

ProPlot's interface will look spartan indeed if you've been weaned on windows, icons, and scrollable menu bars. In fact, it's more appropriate to say that *ProPlot* doesn't have a screen interface at all, just a simple access system for generating and printing graphs. To create a graph in *ProPlot*, you must use your text editor (*ProPlot* doesn't supply one) to write a script that describes the graph and its options. *ProPlot* can take simple commands as arguments at the DOS

GRAPHICS TECHNICAL CHARTING

prompt; also, you can call the program from an executable file, so it's useful if you want to plot the results generated by your own programs. But naturally, there's no mouse support, and to see what you've produced, you have to actually plot the points to the screen.

Fortunately, the *ProPlot* command language is simple and easy to learn. Its syntax is logical, so learning to write a command file doesn't take much time. The documentation is complete, and the software comes with plenty of well-annotated sample script files. If *ProPlot* has problems translating your script file, it gives you a well-documented error report with suggestions for correcting the specific problems encountered.

PLOT ME NO PIES

ProPlot is designed primarily to plot data points in the x,y plane; it can't plot three-dimensional data. Though it can do bar graphs, this function doesn't work very well; it's hard to use, and it can't draw histograms from raw data. You can't create pie charts or high-low-open-close type charts with this program, either.

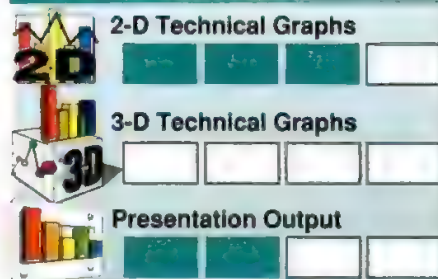
What *ProPlot* does, it does well, though. It offers a good range of technical scaling and plotting options, including error bars, and it can fit multiple plots on one page, overlay one graph on top of another, and even fit one graph into a small window within another. Though you obviously can't position chart elements interactively, *ProPlot*'s language does let you annotate and resize graphs, control tic marks, and rescale or multiply coordinates fairly easily. The program defaults are thoughtfully set up, and it

doesn't take much work to make a good-looking graph.

If *ProPlot* has a weakness, it's in data handling. You can plot an unlimited number of data sets in each graph, but each data set is limited to 1,024 data points (an optional version of *ProPlot* that requires more memory can plot up to 5,000 points per series). While the software accepts data in a number of different ASCII formats, including print image (Lotus .PRN) format, it can't use .WK1 or other spreadsheet files directly. And while you can reorder the columns in a data set with respect to the coordinates and error bars, you can't aggregate and otherwise

SUITABILITY TO TASK

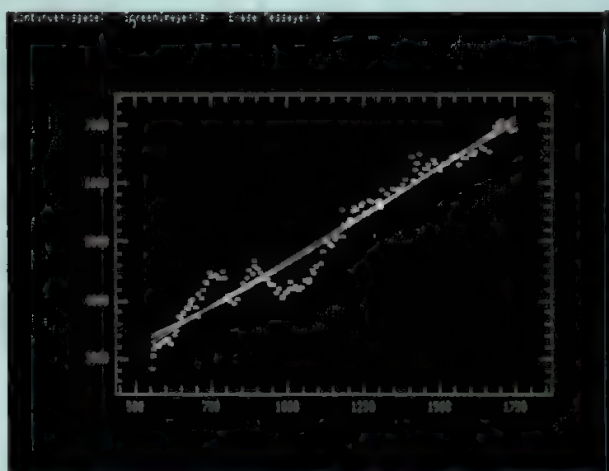
PROPLOT



manipulate your data using *ProPlot*. It can fit curves to data using the least-squares method, however, and it calculates and reports the coefficients when fitting regression polynomials, but the version we tested didn't let you plot mathematical functions.

A HIGH DRAFT PICK

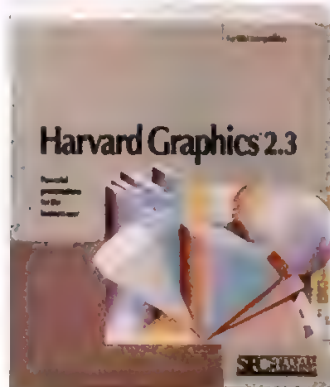
Though the output on screen and on dot matrix printers is of draft quality only, it is surprisingly sharp. In fact, I got the best-



ProPlot produces only 2-D plots in black and white but offers a good range of technical and scaling options. With a PostScript printer and a little effort, it will yield publication-quality results.



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SDS

by Kaare Christian

looking printout I've ever seen from my trusty old 9-pin dot matrix printer, a Panasonic KX-P1080i. *ProPlot* prints out quickly, too, with none of the quadruple overstrikes you get with some other programs.

ProPlot really comes into its own with a PostScript printer, which lets you print crisp-looking black-and-white plots (the program doesn't support color). You can copy PostScript output to disk files for

***ProPlot's* defaults are thoughtfully set up. It's fairly easy to make a good-looking graph.**

rendering on PostScript typesetters, or you can write plots out as .EPS files for easy incorporation into published documents. Cogent Software supplies a PostScript emulator so that you can get the same results on Hewlett-Packard LaserJet and DeskJet printers. In addition, the program offers a robust set of symbols and fonts, including Greek characters, mathematical symbols, subscripts and superscripts.

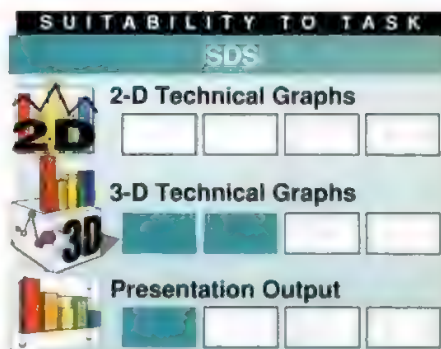
Clearly *ProPlot's* command-driven design isn't for everyone, but it does make super-looking graphs from numerical data, and its PostScript support makes it a simple and flexible tool for getting publication-quality charts and graphs out of ASCII data files.

SDS is a sophisticated 3-D graphing program designed for a professional/technical audience that needs to turn raw numbers into 3-D wireframes, contour maps, or filled contour maps. Though its command-line interface is an acceptable choice for its technical audience, it's something of an anachronism in the PC arena.

SDS requires you to specify all values by typing short assignment statements. These values are displayed on the screen, however, which makes it easier to keep track of the current selections than you might imagine. As an added benefit, *SDS* commands can be placed in a file and executed in batch mode, which makes it easier to use *SDS* as part of some larger data analysis system. This is not to imply that *SDS* is particularly user friendly. There is no command recall system for editing typos—almost unthinkable in a command-based program—and you can't assign commands to function keys. *SDS* does allow you to abbreviate commands, however—its sole concession to user convenience.

One of the program's most commonly used commands is Plot, which switches your display into graphics mode and then quickly draws the graph. (Most of the graphs I displayed were drawn in 2 or 3 seconds on a 25-MHz 386.) You can control the viewing position of the resulting 3-D wireframe by typing in *x*, *y*, and *z* coordinates. For example, you can view your data from "below" by typing in a

negative *z* viewing position. You can't use the arrow keys interactively to make view position changes or use the on-screen *x*-, *y*-, *z*-axes to find an optimal view, however. *SDS's* very static approach to view position was appropriate for the much slower machines of five years ago; the fast machines of today could use a more interactive viewing system.



ROUGH EDGES

The *SDS* manual advises that the installation procedure is "finicky," but that's putting it mildly. Far too many options must be specified using SET commands in the AUTOEXEC.BAT file, and the installation program is absurdly sensitive to minor difficulties, such as an off-line printer. The error messages are useless; I had to call technical support to help me get the program running. Once I got over this hurdle, though, I didn't encounter any further problems or need any further help. The manual's quality is mixed: It contains a useful description of gridding methods, but the command reference is very terse; information on installation and on graphics drivers is scattered; and the index is

FACT FILE



ProPlot,

Version 1.0

Cogent Software,

1030 Pine St.,

Menlo Park, CA

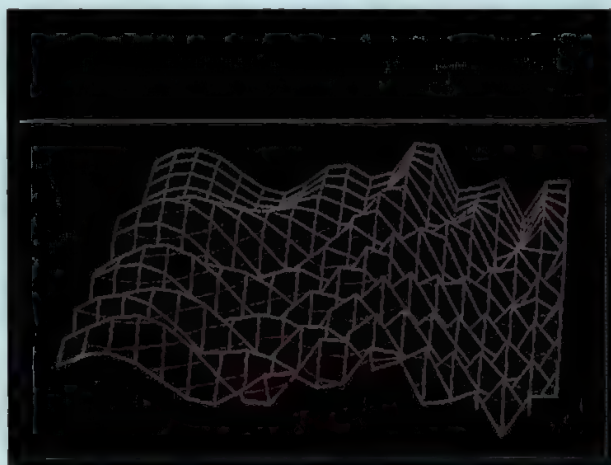
94025-3405; 415-

324-4360.

List Price: \$169

Requires: IBM XT, AT, or compatible; 512K RAM; DOS 2.0 or later. Graphics adapter and PostScript printer recommended.

In Short: Though it's limited to producing 2-D plots in black and white, PostScript support and a low list price make this command-based package an attractive choice for generating publication-quality graphs from custom-written programs.



SDS produces acceptable, if not snappy, 3-D wireframes, contour maps, and filled contour maps for a technical audience.

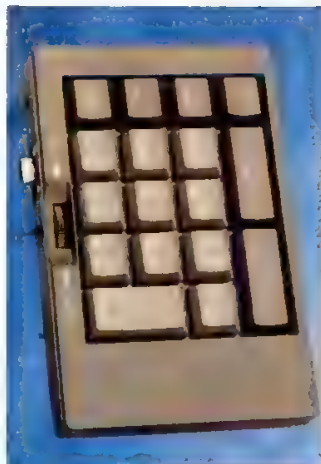
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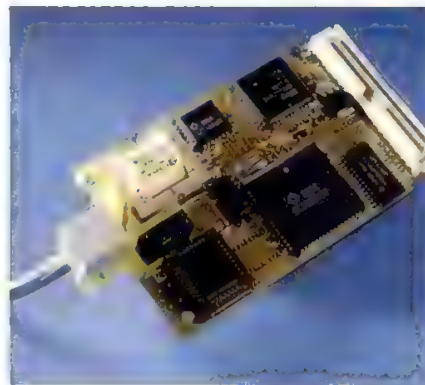
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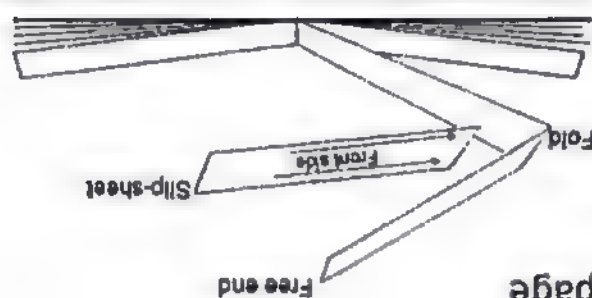
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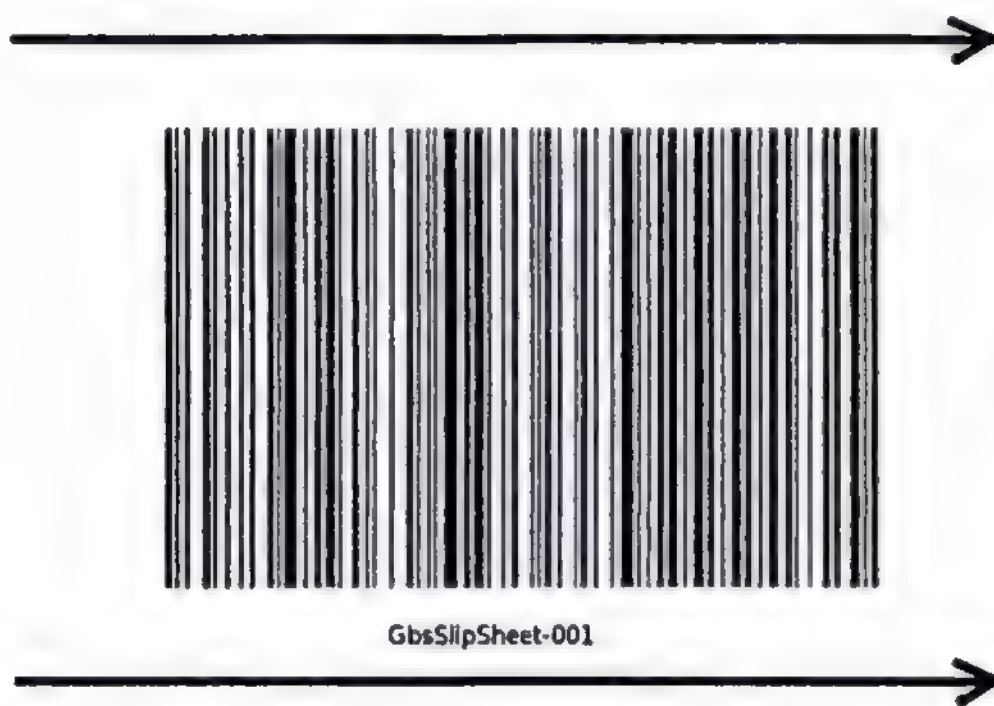
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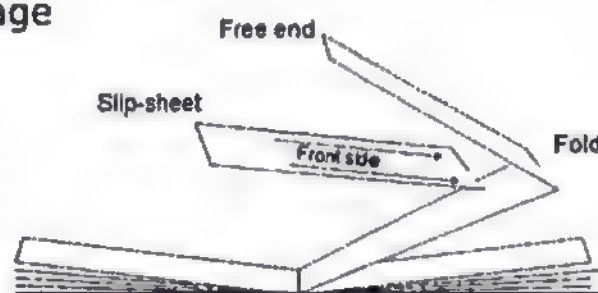
1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

Inverted Foldout slip-sheet



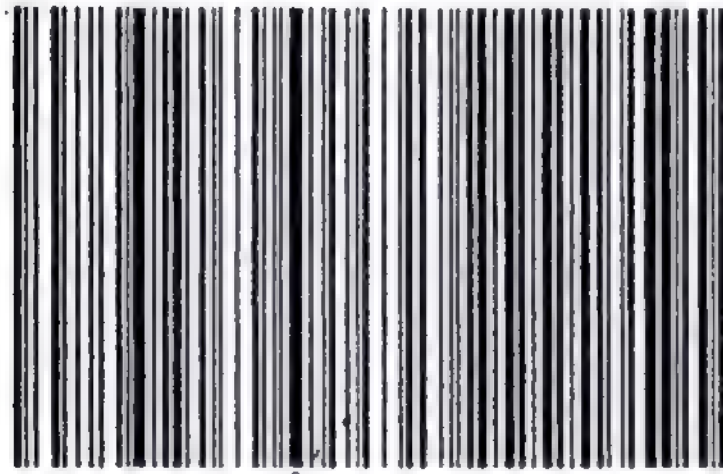
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



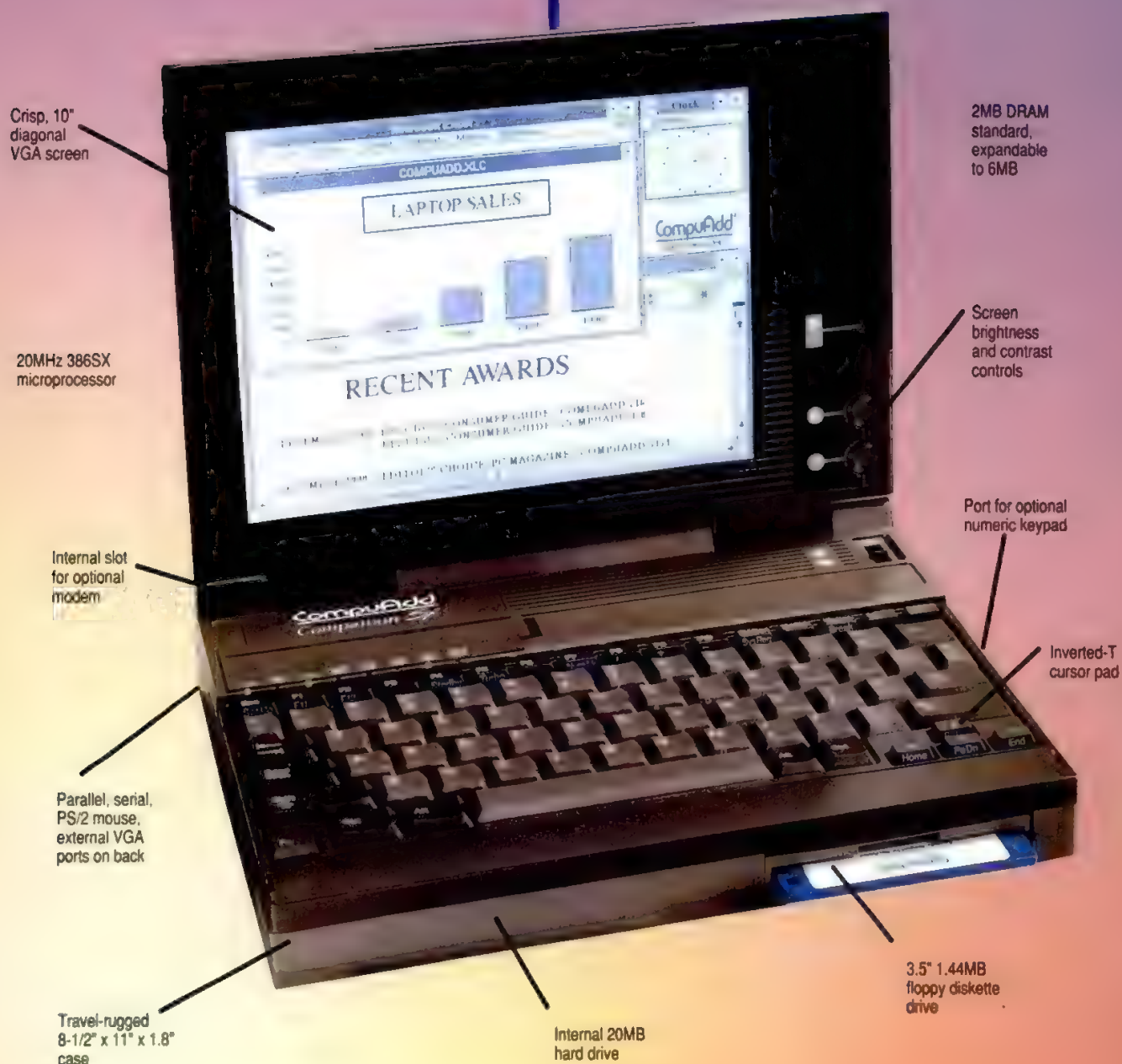
GbsSlpBack-0018

Back

1. Follow instructions on the other side

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- System Price: \$2895 (62205)**
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nothing less than abysmal.

SDS has some other limitations, as well. The only way to get data into the program is to import it from ASCII files; you can't key in the data directly, and the program does not support .WK1 or other PC data formats.

Each SDS data file begins with a header, which you will have to add manually with a text editor. The header contains a few simple commands that identify the layout of the following data. This data can be presented in x,y,z format, or as a table of z values.

X,y,z-format data must be gridded to produce a table of z values. This conversion is one of the strengths of SDS, however. The program features four separate methods for gridding, so you can choose the method that works best with your data.

VIEWING REFINEMENTS

SDS contains a wealth of features for refining your presentation, including transforming the z values by typing in a formula, changing the viewing perspective and colors, or specifying high and low clipping points. You can also read in a standard map to be displayed with a contour map. This allows you to plot water-table-depth contours on top of a county map, among other things.

Although SDS includes many mathematically oriented features, it has few esthetic features. Titling options are limited, and you can't stratify the display to differentiate higher z values by color, adjust line thickness, or place axes on a wireframe plot. The wireframe display does include isoelevation lines, but they are hard to see and interpret.

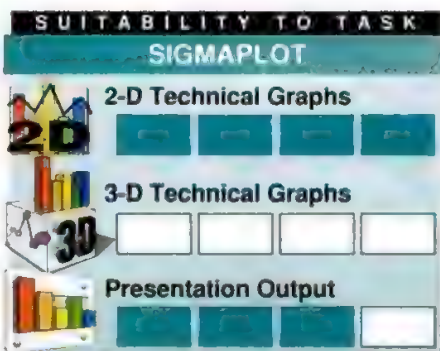
SDS has many blemishes: Its installa-

tion procedures, documentation, and error messages need to be vastly improved; its user interface is outdated; and its output isn't the most attractive. Though it charts smoothly and reliably, for \$450 one has a right to expect more.

SigmaPlot

by Roger L.T. Oehmke

Jandel Scientific has hit the bullseye with *SigmaPlot*. This \$495 product gives scientists and engineers an excellent tool for exhibiting and studying experimental and theoretical data, with exceptional trans-



formation language and curve-fitting power and even some statistical analysis functions.

While *SigmaPlot*'s basic technical charting capabilities are full-featured (it handles a wide range of two-dimensional charts, including scatter and line plots, bar charts, pie charts, and box plots, but does not plot three-dimensional data), its real strength lies in its powerful curve-fitting

and transformation capabilities. It offers, for instance, both regression-based and nonlinear curve fitting. The regression feature is extremely simple to use, can be automatically graphed, and lets you fit up to a 10th-order polynomial to any plot.

With the nonlinear curve fitter, you can find a model for your data or explore new mathematical models by simply inputting an equation or a series of equations with up to ten variables and 20 constraints and letting *SigmaPlot* do the work. The results can then be written to the worksheet and graphed right along with the original data for comparison.

THE POWER OF LANGUAGE

For data handling, *SigmaPlot* offers an entire transformation language that is powerful beyond many users' needs. With this language you can write mathematical equations using columns of data as arguments. Converting raw data to engineering units, changing engineering units, or smoothing data are simple tasks for this program. An ambitious set of trigonometric, common, and natural log functions, statistical functions, and arithmetic, logical and relational operators make even more involved tasks relatively painless to carry out.

For statistical comparison of your data sets, *SigmaPlot* offers a Student's t-test, invoked from the Math dialog in the main menu. Results from the Student's t-test include the statistic t and the probability that the two selected data sets have the same mean. Column statistics are also available on demand; these are particularly useful for determining graph axis ranges if you don't want to use those automatically chosen by *SigmaPlot*.



SDS, Release 2.32
Datanalysis, P.O.
Box 45818, Seattle,
WA 98145; 206-
682-1772.

List Price: \$450

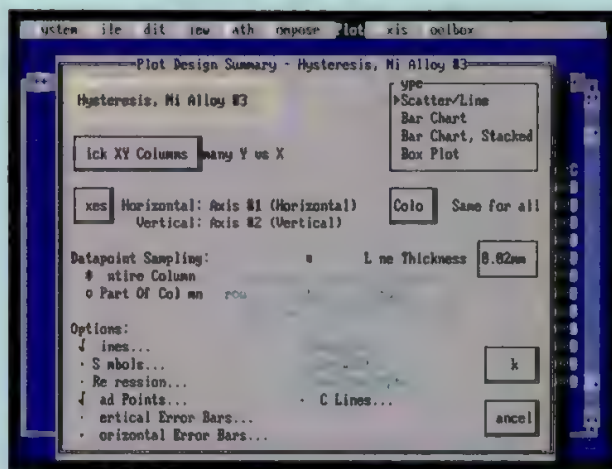
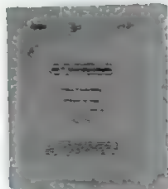
Requires: IBM AT

or compatible; 640K

RAM; graphics adapter, math coprocessor,

DOS 3.0 or later.

In Short: SDS reliably and effectively charts 3-D wireframes, contour maps, and filled contour maps but is marred by overly complex installation, disorganized documentation, and a command-line interface that is something of an anachronism in the PC arena.



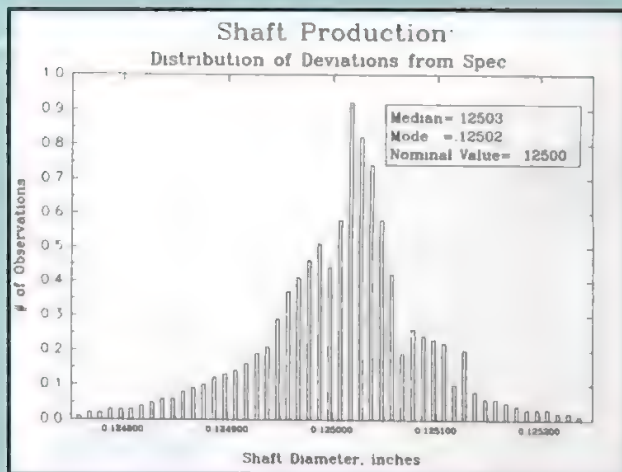
SigmaPlot has some of the most powerful technical graphing abilities you'll see, but they're not enhanced by its clumsy interface. To create a graph, you must fill out an almost endless number of dialog boxes.

MAKING TECHNICAL DATA PRESENTABLE

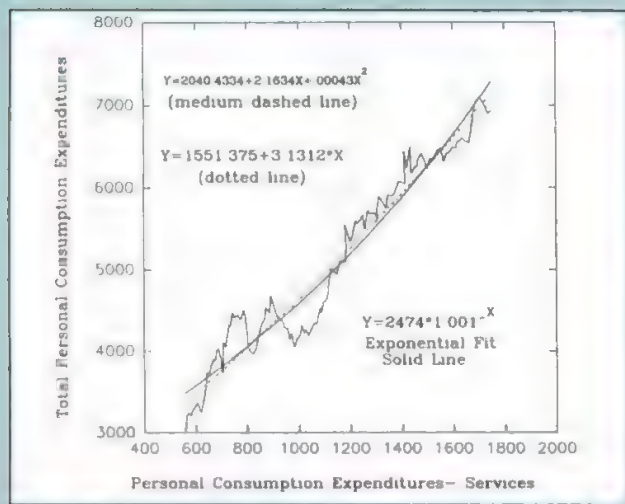
by Gayle Ehrenman

Technical plots and charts are indispensable tools for analyzing complex data, showing trends and patterns, and helping you identify gaps and problems in your research. But they're not always shown to an audience of one, so it's important that your technical graphics package be flexible enough to create attractive output suitable for presenting to others.

So, once you've found a technical graphics package that does the things you need it to do, you should also consider how stylishly it does the job. As you'll see in these examples, the same data can look very different, depending on how you plot it and on how well you can dispose its titles, legends, and annotations. Finely drawn lines and fonts may be the best choice for plotted or laser-printed output, but it's likely to disappear in less precise media. And skillful use of scaling and annotation options can make the difference between an arresting view of your data and a complicated mess.

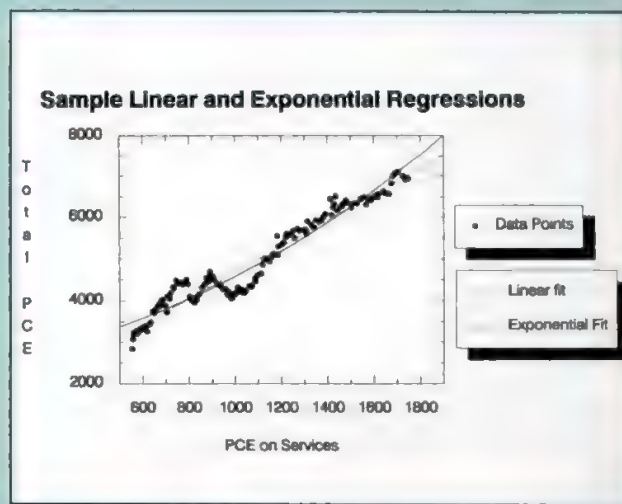


Many technical graphics packages let you produce histograms, a special type of bar chart that shows the distribution of the data. Showing the values for each bar isn't as important as making sure that the overall pattern is clear. But text annotations are helpful for calling attention to the values that are important within the overall pattern. In this example (from *SigmaPlot*) the median, mode, and nominal values are all indicated, making it easier to see at a glance how close to normal the distribution of the data is.



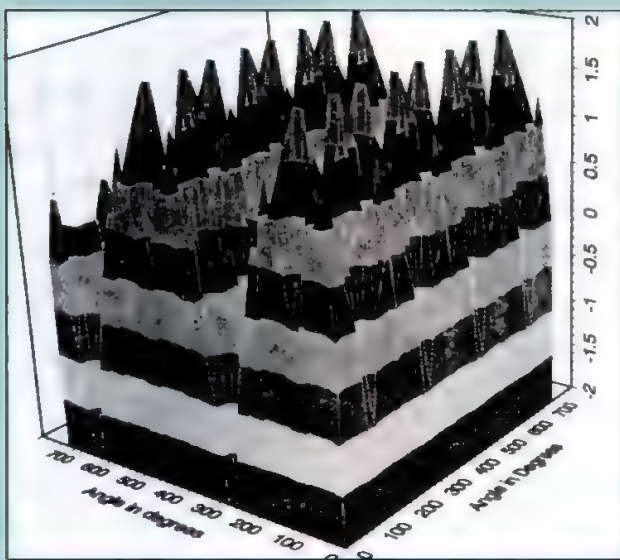
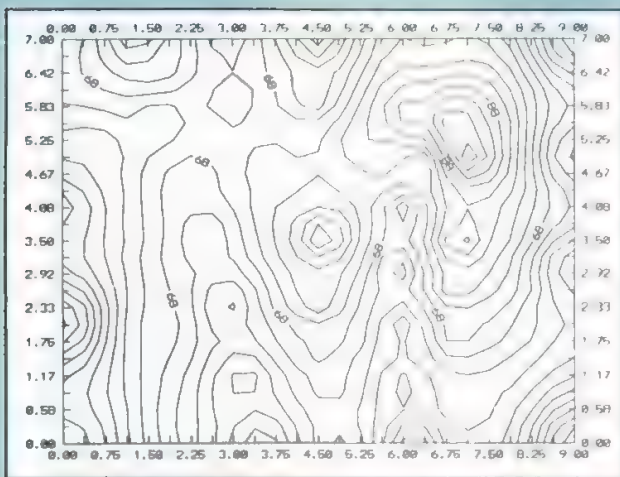
Depending on where you plan to publish it, how you plot can be as important as what you plot. A continuous jointed line, overlaid with a continuous curve (shown on the left) does a good job of making precise data readable while showing its trend. Though this graph (which happens to come from *SigmaPlot*) does not have the publication-quality scalable fonts offered by some other packages, its precision makes it very professional-looking in laser-printed reports or scholarly reviews.

Delicate lines don't hold up well on the big screen, however, so if you want your graph to translate well in a slide presentation, you'll probably use a different approach. The plot on the right (from *GraFit*) shows the same data, but instead of a slim jointed line connecting



the points, it plots the points as large, dark dots that are easily visible. The curve shown with the points is similarly thick and dark, so that it stands out enough to tell the story. Graphic tricks (such as the drop shadow behind the legend box) also help make this graph more dramatic.

Scaling and legends influence readability, so it's worth tinkering with the defaults for best results. In these examples, the rectangular *GraFit* graph uses axis-to-axis scaling, while the square *SigmaPlot* graph begins scaling below the axis and continues above the top, making the data look less cramped. *GraFit* produces legends that graphically key the curves and data points, while *SigmaPlot* lets you print the curve-fitting equation as an annotation right on the graph.



Presentation is of even greater importance when it comes to plotting data in three dimensions. The contour plot on top is a good basic way of presenting three-dimensional data in a two-dimensional form. But though it is useful for analytical purposes, it doesn't let you see the elevations or visualize the functions of the data. Moreover, this particular plot (from *Surfer*) leaves much to be desired: The font is crude, though legible, and the limited annotations (the elevation markings) make the plot seem confusing: Are those numbers 68s or 89s? And why aren't more of the elevations marked?

The three-dimensional plot shown on the bottom (generated by *Graftool*), by contrast, shows the entire surface in perspective, lending an air of immediacy to the entire graph and giving you many alternate viewpoints. At the same time, the use of color strata (shown in gray shades on this laser printout) makes it easy to see the differing elevations. *Graftool's* text and annotation options (including labels skewed according to the axis perspective) support its charts ably; despite the graph's complexity, the readability of the data is not lost among the visual tricks but instead is enhanced by them.

Note that you must pay a penalty in print speed for all this flash. *Surfer* printed the straightforward contour plot quickly, while *Graftool* took far longer to generate the complex 3-D contour with its perspective labels.

POWER BEFORE BEAUTY

Elegance takes a backseat to power in *SigmaPlot*, and nowhere is this more evident than in the interface. Though logically laid out, it is somewhat cumbersome and tedious to use. You must fill out a seemingly endless number of dialog boxes to create a graph, and it's all too easy to get lost among the multiple plots and graphs.

Using a mouse to change items from the graphics window can help you navigate around the problem, however. To change an axis range, for example, you simply click on the axis and its dialog box appears. Editing in the graphics screen is equally uncomplicated and can be accomplished by a combination of mouse clicks and keystrokes. For instance, to erase an entire graph, you click on the graph and hit the delete key. Graph components can also be copied and deleted using the same technique. Unfortunately, since you are working on a graphics screen, the process is somewhat sluggish.

GOOD LABELS MAKE GOOD GRAPHS

Knowing that good graphs are well labeled, *SigmaPlot* provides the text-labeling capability needed to make the task a snap. Text can be placed anywhere on the page and editing is straightforward, but perhaps the greatest pleasure of all is being able to place subscripts and superscripts easily. The up and down arrow keys invoke superscript and subscript respectively, while exiting either mode is done by pressing the left or right arrow keys. The program includes Greek and math character sets and the degrees symbol. Boxes, circles, and ellipses are available for enclosing annotations. When you're ready to plot, you can preview the



FACT FILE

SigmaPlot, Version 4.0

Jandel Scientific, 65 Coach Rd., Corte Madera, CA 94925; 800-874-1888, 415-924-8640.

List Price: \$495

Requires: IBM XT, AT, or compatible (286 or 386-based PC recommended); 640K RAM, graphics adapter, DOS 2.0 or later.

In Short: *SigmaPlot* offers a powerful data transformation language and exceptional curve-fitting power but is burdened by a cumbersome interface and insufficiently detailed documentation. Its output is crisp but handicapped by a limited selection of fonts.



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results on your screen with a facsimile of the whole page that looks very much like the final output.

SigmaPlot's output is crisp and finely detailed. You can print in black and white to any of a range of printers and plotters, including *PostScript*, or export to CGM and HPGL formats. *SigmaPlot* can even print to several different film recorders for producing slides, and color *PostScript* support is expected to be added to the next version of the program. Its only weakness

SigmaPlot makes it easy to produce multiple graphs on standard forms.

lies in its skimpy font support: You can't use high-quality Adobe or Bitstream fonts, and *SigmaPlot*'s built-in typefaces aren't thrilling aesthetically, particularly in the larger point sizes. (Better font support is expected soon, though.)

TIMING IS EVERYTHING

Producing multiple graphs in standard forms is easy with *SigmaPlot*'s template feature. After you have all the graphs you want, you can use the batch printing capability to further speed up the production process. The batch printing feature also allows output to be diverted to your screen for a kind of on-screen slide show. You can't mix portrait and landscape graphs in the same batch printing session, however, since this setting is part of the program configuration.

SigmaPlot's documentation is readable and comprehensive but insufficiently detailed, leaving you exasperated when you try to do something complicated. Online context-sensitive help is available, however, and it's very well done.

Jandel Scientific expects to have released Version 4.1, an upgrade that needs less memory, has improved font support, and contains more drivers, by February of 1991. A networked version is expected to follow later in the year. In the meantime, even though it's restricted to two dimensions, *SigmaPlot* 4.0's powerful analysis features make it an excellent addition to your technical toolbox.

GRAPHICS TECHNICAL CHARTING

SlideWrite Plus

by Kellyn S. Betts

Unlike the other products in this review, *SlideWrite* gives you more than just a solid set of technical plotting options. With snappy scalable fonts, a robust set of drawing and annotation tools, and support for slide makers as well as printers and plotters, it's also a full-fledged presentation tool.

With its light blue background and standard group of main pull-down menus, Version 4.0's newly designed graphical interface looks similar to that of *Microsoft Windows* 2.1; indeed, Advanced Graphics Software notes that *SlideWrite Plus* was designed to the same IBM Common User Access conventions that *Microsoft* uses. But despite the similarity in design, *SlideWrite Plus* doesn't behave like *Windows* in every particular. You can't highlight data in pop-up windows by clicking on it with the mouse, for instance, and you can't open multiple MDI-compliant windows, as you can in many *Windows* applications. None of these differences are so pronounced, however, that you can't easily grow accustomed to them.

Indeed, from the standpoint of the veteran user, *SlideWrite Plus*'s most notable feat is its ability to pack hundreds of features together under just five main pull-down menus. This requires a large number of pop-up and pull-down submenus layered on top of one another, which might make it easy to get lost. However, the graphical interface keeps the main menus

within view and allows you to find your way back to your starting place with a single operation.

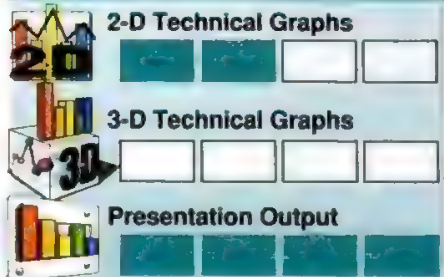
REQUIRED READING

Because of *SlideWrite Plus*'s many features, it's imperative that you spend time reading its documentation. Fortunately the manual is thorough and well written; it combines with the new interface in a way that makes it easy to replicate tasks.

SlideWrite Plus is a solid product for creating two-dimensional plots. It can

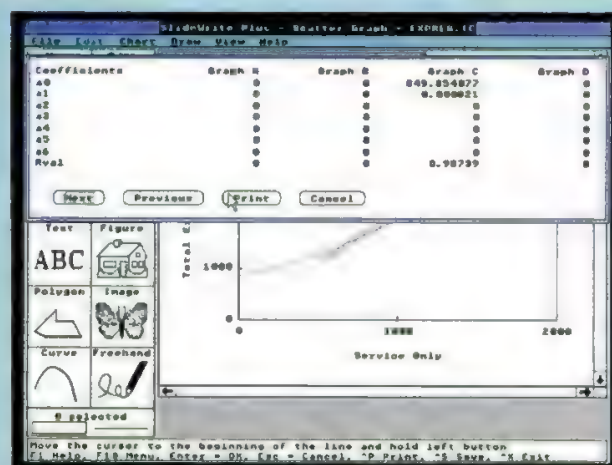
SUITABILITY TO TASK

SLIDWRITE PLUS



produce the standard line, bar, and scatter charts using a wide variety of axis scaling options, including logarithmic, though it cannot plot from cylindrical and spherical coordinates. It has six types of univariate curve-fitting options and the ability to transform data using detailed equations and over 20 different functions.

Some of the details could be improved, however. One annoyance is the program's quirky use of *Lotus* worksheet files. Though *SlideWrite* imports .WK1 files, it can do so only if the data you want to import is defined within named ranges. It is not too difficult to do this in *1-2-3*, of course, and you can always export the spreadsheet to ASCII format (*SlideWrite*



SlideWrite Plus offers an array of drawing tools for dressing up standard 2-D charts. These tools allow you to add annotations, freehand renderings, and clip art to any chart.

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FACT FILE

SlideWrite Plus, Version 4.0
Advanced Graphics Software, 333 W. Maude Ave., #105, Sunnyvale, CA 94086-4367; 408-749-8620.

List Price: \$445

Requires: IBM XT, AT, or compatible; 390K RAM, graphics adapter, DOS 2.0 or later.

In Short: *SlideWrite Plus* produces stunning-looking graphs, and its robust drawing tools and support for film recorders make it useful as a full-fledged presentation tool. But its inability to use either extended or expanded memory, which restricts the amount of data it can handle, is a severe limitation for many technical users.

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GRAPHICS

TECHNICAL CHARTING

640K of RAM is free. Hence the number of points you can import in practice drops precipitously as the amount of free RAM decreases: With 464K free, for example, I was able to load just a little over 1,500 data points. Though this may be adequate for some technical users, it will be an insurmountable problem for those with large banks of data to plot.

OUTSTANDING OUTPUT

If you can get beyond these operational drawbacks, however, *SlideWrite Plus* will delight you with its presentation-quality output. Creating one of the seven main types of graphs from *SlideWrite*'s notebook-like Graph Data Form is a breeze (though more complex options can require many discrete steps), and the snappy results can be dressed up nicely with a good range of title, label, fill pattern, and shading options. A large library of technical signs and symbols and science-oriented clip art is a real boon for creating presentation-quality charts.

In previous versions of *SlideWrite*, drawing tools were contained in a separate module. Now included as an integral

part of the package, these tools can be used to add annotations, arrows, boxes, and even free-hand renderings or clip art to any chart. As with most of the program, the operation of these tools is not as straightforward as it might be. The text annotation tool, for example, requires that you first specify the lower-left corner of the text bounding box, then move the cursor to the upper-right corner to complete the action, all of which is a little cumbersome.

While it may be a bit difficult to enter, the text looks quite good, as do the graphics produced by the program's drawing module. *SlideWrite Plus* comes with four high-quality Nimbus-Q scalable fonts; it also offers nine spline-generated and seven Hershey fonts, which gives you plenty of type to work with. You can preview the chart on-screen before either printing or exporting it to one of the five graphics file formats the program supports.

TECHNICAL SLIDE SHOWS

Though it does not have the robust word charting features supported by the best presentation-graphics packages (the text of word charts must be entered line by

imports space-, comma-, and tab-delimited ASCII files) to avoid the problem, but this is an unnecessary inconvenience.

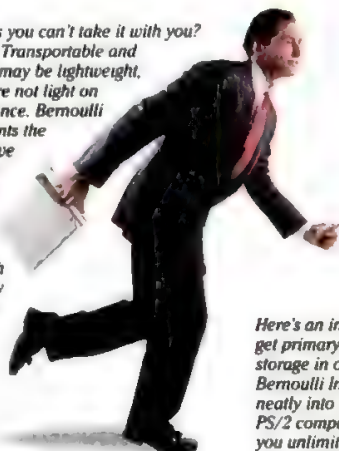
A more serious limitation is the program's inability to use either extended or expanded memory. Though the data sheet is capable of holding up to 4,000 data points, it actually achieves this only if all

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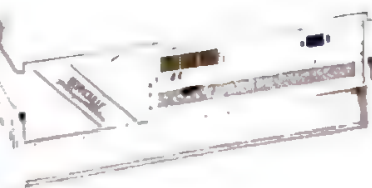
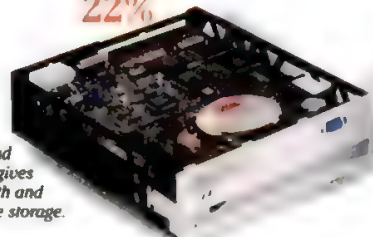
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GRAPHICS TECHNICAL CHARTING

line, without benefit of word wrap), *SlideWrite Plus* does have batch printing capabilities that let you print an entire slide show's worth of charts on a printer or film recorder. (An add-on program called *SlideWrite Presenter*, which costs \$99, substantially enhances these capabilities.) You can easily transmit batches of charts via modem to a slide service bureau, and Advanced Graphics Software will fax you a list of 22 service bureaus capable of working with its software upon request. In our testing, the software produced excellent LaserJet III printouts.

The memory limitations of *SlideWrite Plus* will eliminate its appeal to those who must deal with reams of raw experimental data. But if your data is aggregated enough not to exceed the program's limits and you need a tool for creating good-looking technical presentations, *SlideWrite Plus* makes an excellent choice.

Surfer

by Barry Simon

Low-end users who need to produce simple surface and contour plots are in for smooth

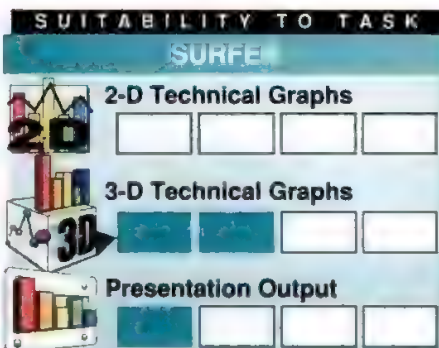
sailing with Golden Software's \$499 *Surfer* program. Though it's marred by a quirky interface, this program offers quick printed output and some valuable features, but at a high cost considering its limited goals.

Perhaps the most significant thing about *Surfer* is that it will work on a modest system; the program doesn't even require a hard disk. But the tradeoff hits you in the form of its awkward interface. The *Surfer* package comes with no fewer than 11 separate executable files, six of which are integrated by a kind of shell program. Moving from module to module through this shell gives a jerky feel to the entire product.

Adding to the jerkiness is the separation of the displayed graph (in preview mode) from the character-based menu system. You can control a few items, like text placement, interactively from the preview screen. But most such options must be specified on character-based forms, so it is necessary to shift back and forth between the menus and the preview screen to see the effects your changes have made.

GRID-LOCK

The first step in a session with *Surfer* is to use the data preparation module called GRID, which prepares proprietary binary files for the other modules to use. The GRID module can import ASCII or .WK1 files, and it can also be used to generate a z value as an explicit function of x and y .



using algebraic, trigonometric, logarithmic, and Bessel functions. *Surfer* can handle up to 26 columns and 14,000 rows in its worksheet. This may seem like quite a lot, but for xyz triples over a square xy range, it allows roughly only 120 by 120 points.

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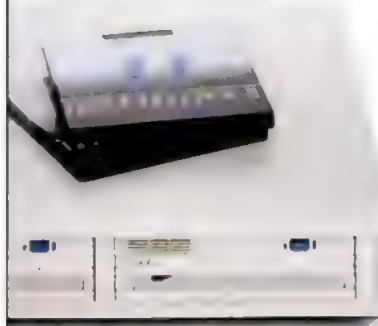
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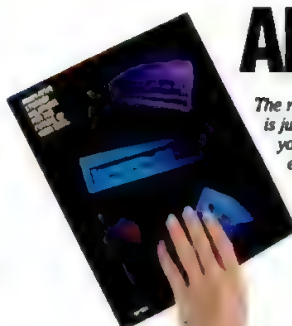


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FACT FILE

Surfer

Golden Software,
809 14th St.,
Golden, CO 80401;
800-333-1021, 303-
279-1021.

List Price: \$499

Requires: IBM XT,
AT, or compatible;
320K RAM, DOS
2.0 or later.

Graphics adapter recommended.

In Short: *Surfer* produces acceptable three-dimensional plots and has good print speed even on low-end systems, but its limited capabilities and innately awkward design, coupled with its high price, make it less than the best choice for this work.



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The worksheet has a few data manipulation tools like column move and functional transformation of one column to another, but it has little of the feel of a real spreadsheet. Its real strength is a set of algorithms for interpolating missing data points, especially for nonrectangular sets of x, y points. While you can turn data into rectangular form automatically, you can, if you prefer, change many of the internal options. Surprisingly, though, *Surfer* does not support cylindrical or spherical coordinates.

Once you have the data saved in the required format, you have to switch to individual modules that print contour and surface plots. The TOPO module prints the contour plots, while the SURF module prints various types of surface plots. The two programs have a number of menu items in common, but this separation prevents you from mixing the two types of plots on a single graph. You can mock up

GRAPHICS TECHNICAL CHARTING

a shadowed contour plot (surface with a contour projected below) by using multiple surfaces, one of them scaled to be a flat pancake showing only the contours, but this is hardly the easiest or most natural solution.

PERKING UP THE PLAIN

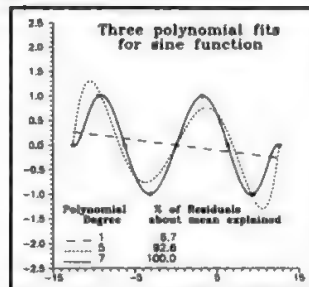
The SURF module has a number of options that can make a plain surface look great. You can display a base with or without mesh lines and switch between orthographic and perspective views. While viewing a surface, you can move titles and legends using Alt-key sequences. You can even color the surface in bands, depending on the value of the z coordinate, though in this case you'll need a plotter or color printer to display the banding because SURF doesn't convert colors to gray scales on monochrome printers. TOPO also has some useful options, such as making some contour lines darker than others.

Surfer's UTIL program offers some unique extra features, such as a function that will compute the surface area of a surface plot from a data file. If you give it a second data file or use a coordinate plane, it can even calculate the volume. Another special feature is *Surfer's* batch mode, which lets you create command files to automate any graphing session.

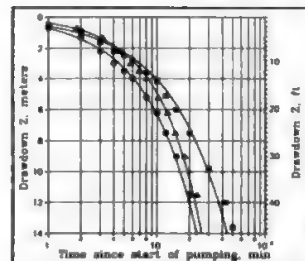
The defaults for the various modules are set with a command file that executes automatically each time that the module loads. In order to change the defaults, you need to edit these command files; this is hardly an elegant method, but it can be a boon to the power user, who can integrate these command files with his or her own.

Surfer features two separate modules with a variety of options for drawing contour and surface maps. While you can't mix modules, you can use multiple surfaces to achieve interesting effects.

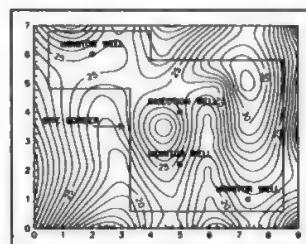
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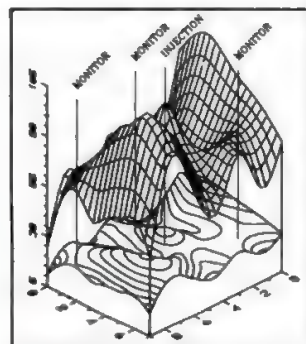
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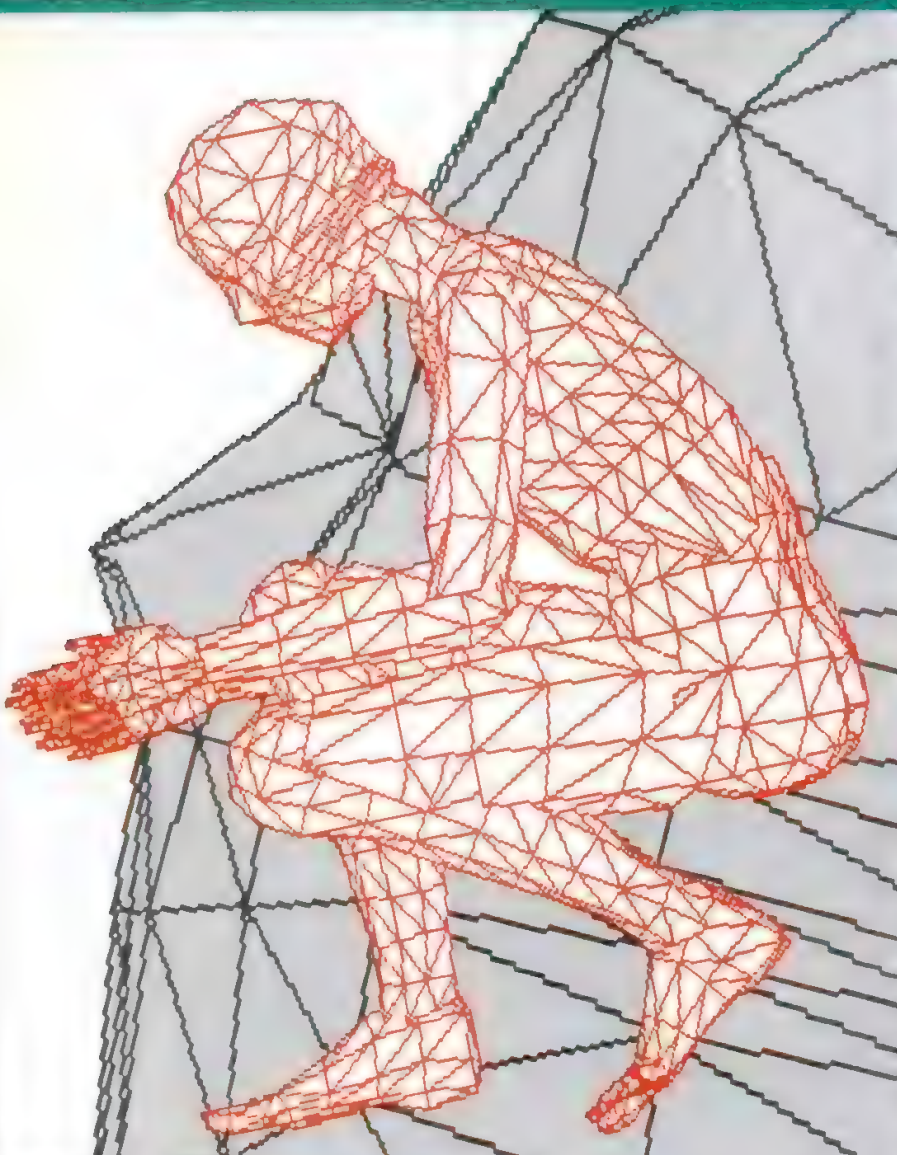


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OUTPUT OKAY

Surfer's output, while not elegant, is of decent quality. It comes with 18 proprietary vector symbol fonts including Greek and Cyrillic, plus some dingbat and symbol fonts. Though these are not quite as nice as Adobe or Bitstream fonts, they can be scaled without degradation. Unfortunately, *Surfer's* text handling is rudimentary at best: You can adjust the size and position of text manually, but you cannot center or justify text in a box. Annotation capabilities are also weak, and you can't export the results to a graph-

Surfer's output, while not elegant, is of decent quality, and printing is quick.

ics file, which limits your publishing flexibility. On the other hand, printing proved to be quick; quite a refreshing contrast from *Graftool*.

Surfer is worth your consideration if you have a special need for the data interpolation and area/volume features that are its specialty, or if print speed is a major consideration. But its innate awkwardness makes other products a better choice for most users.

Tech*Graph*Pad

by Tom Unger

Want an easy-to-learn, menu-driven scientific graphing package? Then take a look at Binary Engineering's \$395 *Tech*Graph*Pad*, Version 4.0. It doesn't have a long list of fancy features—it won't handle 3-D graphing, for example—but it does have a good selection of basic features in any easy-to-use package.

*Tech*Graph*Pad* comes with an installation program that lets you install drivers for three output devices, including two printers (one for draft output, one for high-quality copy) and one plotter. You can also customize the program for screen colors, data and worksheet directory locations, default graph parameters and size, and default orientation (portrait or landscape).

Not just the installation is simple with *Tech*Graph*Pad*. The program interface contains a number of hierarchical pop-up menus that "stack" across the screen as you choose options, from recalling an already-saved graph through changing or adding labels to the graph's axes. Although having to stack and "unstack" these menus can become tiresome, Binary Engineering has made the action of graph-

ing your data as simple as possible. Simultaneously pressing the Ctrl and PrtSc keys at any point in the menu structure will produce your graph full screen, provided you aren't in the process of changing basic parameters such as axis length or delimitation.

EASY IN, EASY OUT

*Tech*Graph*Pad* will read virtually any ASCII file, and it will also import *Lotus*

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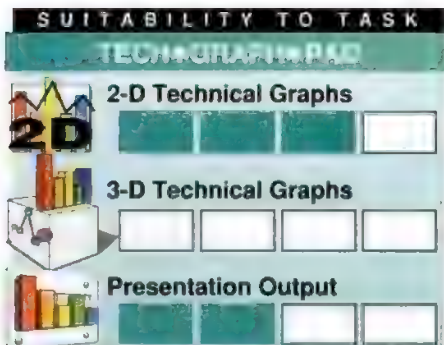


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1-2-3 and *Quattro* spreadsheet files. Should any of these files not be organized according to *Tech*Graph*Pad*'s standard columnar format, you can use the program's simple ASCII editor to effect the necessary changes. In the case of our generic test data, we found it easier to use a spreadsheet program to properly format the *x,y* pairs and then reimport the data. The ASCII editor is not particularly robust and is intended only for simple editing tasks.

You can create, alter, or merge data



files from the file editing menu. You can also exchange *x,y* values, scale or transform data, or insert *x*-values into a data file. In addition, *Tech*Graph*Pad* allows you to perform some minimal DOS functions, such as copying, deleting, or renaming files.

You can save graphs in one of five different formats: *Tech*Graph*Pad*'s standard .ATB format, used for storing and later recalling graphs for screen display; encapsulated PostScript format (.EPS); standard PostScript (.PSF); Lotus .PIC; and HPGL.

*Tech*Graph*Pad* supports standard U.S. and European letter-size paper for direct printing on dot matrix and laser or

ink jet printers. *Tech*Graph*Pad* will also print on both A- and B-size plotter sheets. The program allows you some control over the graph's placement on the page, although the interface for this is a bit cumbersome.

THE CHOICE IS YOURS

Once you've imported your data, *Tech*Graph*Pad* places the file in the "Data Files To Use" listing and lets you make some basic choices about your graph. You can choose the size, shape, and color of the data-point symbols, the location of your axes, and whether or not you wish your points to be connected by a line.

*Tech*Graph*Pad* has an impressive array of formatting commands, allowing up to ten symbols per graph, with a maximum of ten data sets overlayed on the same graph. Should you need more than ten data sets, you can overlay as many different graphs as you find necessary. *Tech*Graph*Pad* gives you eight colors to work with and lets you choose them by number from a color key.

*Tech*Graph*Pad* does provide for some limited font support. If you're sending output to anything other than a PostScript-compatible printer, you can use *Tech*Graph*Pad*'s built-in font, which gives you a choice of five different sizes. If you are sending output to a PostScript-compatible printer, *Tech*Graph*Pad* allows you to choose from five fixed font sizes ranging from 8 to 18 points in Times, Helvetica, or Courier. Each of these faces gives you the choice of regular, italic, bold, or bold italic.

On our sample files (which was done on an HP LaserJet-compatible printer),

*Tech*Graph*Pad* produced clear output even in the smallest type sizes. And although the program does not offer direct output to film recorders, the graphs you create can be saved in encapsulated PostScript format (.EPS) for easy transmission to other programs.

The program also offers a choice of two types of graphing labels. The first, called "graph labels," comprises six fixed labels of up to 50 characters, including up to four axis labels, a header, and a footer. The second type, called "data labels," is flexible: You can place up to ten 50-

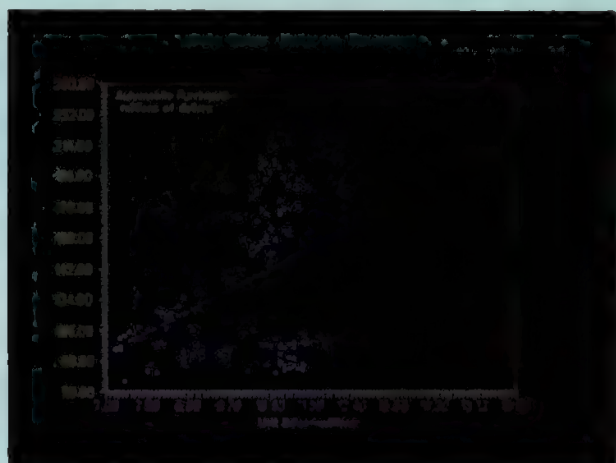
**Binary Engineering's
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supports standard
U.S. and European
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or ink jet printers.**

character data labels on a graph, then size and move them anywhere. You can choose the color of both Graph and Data Labels, but Graph Labels can be positioned only vertically and Data Labels only horizontally.

SPEED AND AUTOMATION

Although *Tech*Graph*Pad* does not make use of a math coprocessor, it handled all of our 2-D graphs—curve fits, exponential regressions, standard scatter plots—with alacrity. And printing proved speedy; it did not take more than a minute to print out graphs on an HP LaserJet clone at 300-dpi resolution.

Perhaps more important than raw printing speed is the addition of Auto*TGP, an add-on macro-building facility that enables programmers and users to integrate their data-acquisition and analysis software with *Tech*Graph*Pad*. With Auto*TGP, users can create "push-button" graphs from *Tech*Graph*Pad* attribute (.ATB) files using templates they designed. This feature makes it possible for those who are not familiar with



*Tech*Graph*Pad* produces useful, if generic-looking *x,y* plots. It supports a good range of curve fits, such as the first-order polynomial fit shown here.

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Tech*Graph*Pad
supplies users with
all the basics, and
then some.

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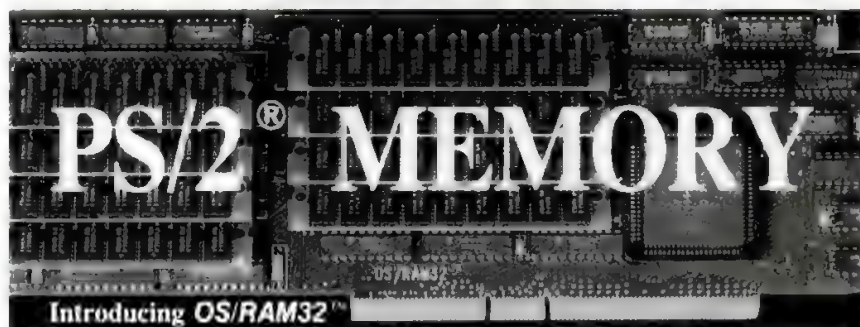
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PC Magazine: 12/11/90: Ziff Davis Publishing: 9600-BPS MODEMS: Breaking the Speed Barrier: PC LAN Labs tests seven rapid-fire modems complying with V.32/V.42 and V.42bis standards.

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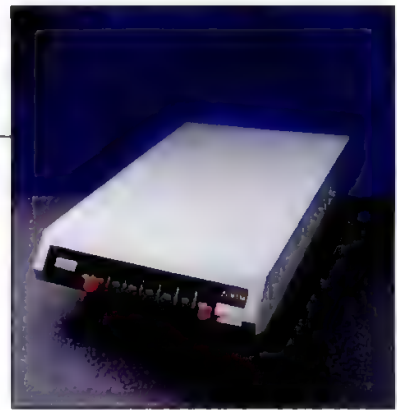
2,400-BPS MODEMS

Affordable Access

Modems that use the V.22bis signaling scheme to move data at 2,400 bps and also offer MNP 5 data compression now typically sell for under \$300. In a few cases, that price even includes V.42bis data compression.

Knowledge is power, and PC users have access to an abundance of knowledge via on-line services like CompuServe and GEnie. Just about all they need to get connected is an account number and a modem.

Investing in a modem needn't be an expensive proposition. Although high-speed 9,600-bit-per-second (bps) modems complying with V.32, V.42, and V.42bis standards list for anywhere from \$700 and up (see "9,600-bps Modems: Breaking the Speed Barrier," *PC Magazine*, December 11, 1990), those using the V.22bis signaling scheme to move data at 2,400 bps can be found for hundreds of dollars less. Our evaluations show that the bargain is not only in the price; among the 2,400-bps modems we review are products that offer easy setup, innovative design, and other attractions.



*by Frank J. Derfler, Jr.,
and Mike Byrd*

Interoperability is not a problem for modems subscribing to the V.22bis standard. While some 9,600-bps modems can be temperamental when talking to other vendors' 9,600-bps models, these 2,400-bps modems displayed no compatibility problems when transferring data to two other devices.

REVIEW CRITERIA

The 2,400-bps modems we review here are all external models (see the sidebar "Turning an External Modem Inside Out"). All use V.22bis signaling and provide MNP 5, Microcom's proprietary and licensed data compression protocol (discussed in the sidebar "MNP Class 5: Encoding Tricks Move Data Quickly"). With a few exceptions, they are priced under \$300.

Although it was not among our criteria, we were surprised to find that a handful of vendors incorporate CCITT's new V.42bis data-compression scheme at these prices. Any modem providing either MNP 5 or V.42bis protocols necessarily provides error correction as well; the MNP 5 and V.42bis protocols are usable only with MNP 4 and V.42 asynchronous error correction, respectively, in effect.

The modems that meet the criteria include systems from Accton, Anchor, ATI, Best Data, Cardinal, Computer Friends, Computer Peripherals, Everex, Galaxy, GVC, Incomm, Longshine, Micro Integrated Communications, Practical Peripherals, Prometheus, Supra, U.S. Robotics, and Zoom Telephonics.

Additionally, we looked at three modems that meet all our criteria but the price: Hayes Microcomputer Products' V-series Smartmodem 2400 V.42/X.25, Intel's 2400EX MNP, and Microcom's QX/2400t. All are priced above \$300. We made the exception for the Hayes modem because the company's products are a commercial standard that many people use for comparison. Intel makes a modem chip set used by many of its competitors; including the Intel 2400EX MNP lets us see how a leading source of modem power actually puts it to use in its own product. Microcom was included because it developed the Microcom Network Protocol (MNP) standards.

PREPARING FOR ACTION

The modems in this market typically have two RJ-11 telephone jacks, one for a telephone and one for the line to the wall jack. A few have their RJ-11 jacks wired straight

through, so you can use either jack for either connection; in this configuration, picking up the phone while the modem is connected can inject noise into the circuit. Other products designate the telephone and line jacks and allow orderly switching between the two devices through a software command or manual switch.

A handful of modem vendors incorporate not only MNP 5 data compression, but also CCITT's V.42bis standard—all for under \$300.

The major setup task for many modems involves determining what commands you must embed in a setup string and send to the modem to direct it to use the desired error control and data compression protocols, what speed to use on the modem link and on the serial link, and what type of flow control to use on those links. A few of the modems we review have their configurations explicitly included in the setup menus of the most popular communications programs; that inclusion gives you a point of departure from which to customize the setup string further.

The Hayes Standard AT Command Set lets you configure any of these modems for specific operations: You can set the speaker volume, turn it on or off, change the flow control between your PC and modem, or dial telephone numbers. The AT command set also lets you tell the modem whether to use dial tone or pulse, what kind of telephone line (2- or 4-wire) to use, when to answer automatically, and how many rings to allow before answering. For modems with both error control and data compression, the instruction set is extended to control how the modem negotiates its protocols as well as specific parameters within the protocols. Most implementations of the Hayes AT command set also allow you to make changes to your modem

configuration on the fly and store those changes for future use.

GETTING UP TO 2,400-BPS SPEED...

People want to move data quickly and reliably over telephone lines, but the telephone lines aren't generally cooperative. The telephone system was designed to pass analog voice signals. Modems convert the electrical signals inside a PC into audio tones, but the bandwidth of the telephone line limits how fast the audio tones can change frequency to represent the zeros and ones of the computer data. The drive for greater speed took place simultaneously in two areas: how the modems signal and what they say when they signal.

Early 300-bps and 1,200-bps modems in the United States used, respectively, the Bell 103 and 212A modulation schemes. Other countries settled on using signaling conventions described in the CCITT V.21 and V.22 standards. The former uses 0- to 300-bps full-duplex modem transmission; the latter, 600-bps and 1,200-bps half-duplex modem transmission with a reverse channel of up to 75 bps.

The lack of competition and the lack of inexpensive modem chip sets were the major reasons for the relatively high cost of modem products in the 1970s and early 1980s. In the mid-1980s, Rockwell and other manufacturers made a modem chip that not only encompassed the V.22bis 2,400-bps protocol but was also downward-compatible with the Bell and CCITT protocols for 300 bps and 1,200 bps. The availability and compatibility of such modem chips led to the introduction of a multitude of low-cost and high-quality 2,400-bps modems.

...AND GETTING IT RIGHT

As you increase speed, it's important to maintain and preferably improve accuracy. This was accomplished via the development of error-control techniques in both modems and communications software.

The Microcom Network Protocols (MNP) 2 to 4 became the industry's de facto standards for hardware error control. The CCITT caught up with the modem industry in 1988 when it issued the V.42 error control standard. V.42 includes two protocols. The primary one is the Link Access Procedure for Modems (LAPM); the secondary protocol is functionally equivalent to MNP 4.

The desire for greater speed also led to data compression. During data compression, a program (either communications

software or modem firmware) running at one end of the link examines the data ready for transmission and looks for redundant elements. It uses a short data string to replace commonly used characters and redundant data strings during transmission.

Microcom's introduction of the MNP 5 protocol for data compression was followed by CCITT's release, in 1989, of the V.42bis standard for asynchronous data compression using the Lempel Ziv compression algorithm. This algorithm offers a significant improvement over the MNP 5 protocol, both in data compression capability and real-time compensation.

Both error control and data compression protocols are independent of modulation protocols. This is why you can find MNP, V.42, and V.42bis capabilities in both 2,400-bps and 9,600-bps modems.

HANDLING THE DATA

Both V.42 and MNP error control modems segment the stream of data into packets. Each outgoing packet includes a 16-bit (optionally, 32-bit for V.42 modems) cyclical redundancy check (CRC). The CRC is a statistical analysis of the contents of the packet. The receiving modem performs the same statistical analysis on the incoming packet as the sending modem performs on the outgoing packet; if it cannot match the CRC, it asks the sending modem to retransmit the frame.

With no error correction, data is sent with a start bit, eight data bits, and a stop bit. This means that it takes 10 bits to send a single byte in asynchronous mode, and that a 2,400-bps modem can send only 240 bytes per second. With V.42 or MNP error control employed, including packet overhead, you can achieve about 22% more throughput.

Most popular communications software offer error-control and data-compression schemes. These schemes include Kermit, XModem, YModem, and ZModem. These protocols operate *only* during file transfers, while the MNP 5 and V.42bis firmware in modems work all the time.

Communications software packages that include their own error control do not provide optimal performance with modems already using MNP or V.42 error control connections. To take full advantage of MNP or V.42 error correction, you should select the software's no-error-correction option when transferring files. YModem-G sends 1,000 bytes per block without software acknowledgement. Using YModem-G, it is common to see

EXTERNAL VS. INTERNAL MODEMS: A Matter of Choice, Not Throughput

by Frank J. Derfler, Jr., and Mike Byrd

Almost all of the vendors providing products for this review also market internal modems that plug into a slot in your PC. Internal and external modems display few differences beyond their physical configuration. Every organization should use some of each type to meet specific users' needs.

Internal modems have some significant advantages: You don't have to hassle with the proper configuration of an RS-232 connecting cable, the modem doesn't take desktop space, and you don't have to find a free AC wall plug. Because internal modems don't have cabinets and power supplies, they are typically a little less expensive than their external kin. By saving money on these items, manufacturers can usually afford to throw in a communications software package. You can assign most modern internal modems to COM3 or COM4 to save an existing serial port.

The few internal modems limited to the alternatives of COM1 or COM2 can

be difficult to install if the PC already has those ports wired into the motherboard. To use an internal modem at one of those port designations, you usually have to run a special program or move jumpers to turn off the internal COM port.

We reviewed external modems because most of the companies we contacted reported that they were better sellers than their internal devices. Many people like external models because the lights installed on most modems' front panels show them what is happening. A quick glance at the carrier detect, read data, and terminal ready lights tells you if the circuit is still up and functioning. In addition, you can easily move external modems between PCs, but changing internal modems is a project.

You can choose between these types of products based solely on your needs and preferences. There are no other differences in terms of efficiency or throughput. ■

throughputs above 270 bytes per second using V.22bis modems with MNP or V.42 error handling.

Data compression provides the potential for even larger savings during file transfers. For both MNP 5 and V.42bis operations, the data throughput speed varies according to the type of data being transmitted, but both ASCII and binary data are compressed. V.42bis offers a potentially better compression algorithm, and is more robust in the way it dynamically adjusts the compression scheme for the data flow.

If you transmit a file previously compressed with an efficient program like PKZIP or Lharc, the MNP 5 protocol on the modem link will actually slow the throughput. And, as our compressible data performance tests attest, V.42bis is significantly faster than MNP 5 for those file-transfer operations.

IMPROVING THROUGHPUT

Because of data compression, the throughput between two modems can be much

faster than the signaling rate would indicate. Modems signaling at 2,400-bps could be moving files with an effective throughput of 6,000–8,000-bps or even more. However, if you are running your PC's serial port at 2,400 bps, you won't benefit from the increased throughput.

Both V.42bis and MNP 5 provide data buffering, allowing your computer port speed to be faster than the signaling rate used between the modems. All of the modems we reviewed allow you to configure the modem to talk with the PC at 4,800 or 9,600 bps. MNP 5 and V.42bis modems need a little tweaking to give you the best performance. Taking full advantage of the improved throughput of their data compression protocols requires setting the serial port link between the PC and the modem to a speed higher than the connection speed between the modems.

When you configure modems for faster port speed, you must send a setup string to the modem to disable a feature called the BPS Rate Adjust. When this feature is on,



EDITORS' CHOICE

• Zoom/Modem V.42bis

We based our Editors' Choice selection on the idea that you should be able to find a modem that serves as a long-term investment—one that you can use into literally the next century. Our strong recommendation for anyone thinking about the future is to buy a modem with not only MNP 5, but also V.42bis capabilities. Fortunately, prices for these modems are quite affordable now.

Of the 21 modems we reviewed, four include V.42bis. With its combination of speed, features, and flawless performance, the Zoom/Modem V.42bis comes up the winner. The Zoom/Modem provides out-of-the-box V.42bis operation, synchronous communications capabilities, and an impedance-matching feature to reduce echo in the phone line and improve data transmission. Designed to hold large, multi-line desk phones, this solid metal unit will be welcome in corporate offices. At \$299, it costs no more than the majority of modems in its class. Just as importantly, it captured top scores on our Compressible File Throughput test.

Tying with the Zoom/Modem for first place on our Compressible File

Throughput test was Galaxy Networks' \$299 Pioneer V.22bis/V.42bis. Its lightweight plastic case is its biggest drawback, but the Pioneer still deserves honorable mention for its speed and its ability to connect reliably every time. Hayes' speedy V-series Smartmodem 2400 V.42/X.25 receives honorable mention for being able to connect with many different types of PBX telephone systems and for including features like a packet assembler/disassembler for connections to packet-switched X.25 networks. Surprisingly, its premium \$649 price does not buy features found in its less expensive competition, such as a voice/data toggle.

If you just need to get in touch today and want to let tomorrow worry about itself, buy the \$199 LightSpeed 2400LE from Computer Friends. It doesn't include V.42bis, but it rates an honorable mention for supplying goodies like a communications program, a hardware volume control, and an RS-232 cable as a standard part of its package. Best of all, it has the lowest price of all the modems we review here.

it links the port speed to the modem carrier speed. After turning it off, you also must set the Serial Port Flow Control parameter to enable bidirectional control of the RS-232 Clear to Send (CTS) and Request to Send (RTS) lines.

The internal programming in some modems will operate using MNP 5 or V.42bis as a factory default condition, but other modems must be programmed to use these protocols. It's good practice to send a complete setup string to any modem every time it dials.

For most of the modems we tested, the setup string ATJ0\G0\Q3\N2\V1\C1 will disable BPS adjust, disable XON/X-OFF flow control, enable bidirectional RTS/CTS, force a link with MNP error control, show you the status of the MNP connection, and enable MNP 5 data compression.

The setup string AT&K3&Q5S46=138W1&R0S48=128 works to initialize Hayes V.42bis modems for the same conditions using a V.42bis connection. However, not all V.42bis modems are the same: You might have to work with the modem vendor to get the setup string exactly right if it doesn't work out of the box.

Don't forget that you'll also have to set your communications software for the correct port speed and for the RTS/CTS flow control. Once you have the serial port, modem, and communications software initialized for optimum performance, you'll get your data sent and received faster and more reliably.

ABOUT THE UART

Most serial cards have an 8250 (8-bit) or 16450 (16-bit) UART (both operate the same way). When we tested 9,600-bps

modems last year ("9,600-bps Modems: Breaking the Speed Barrier," December 11, 1990), we discovered that the UART (Universal Asynchronous Receiver-Transmitter) can be the weak link in the communications chain. The UART problem also appears with 2,400-bps external modems when the user is operating multitasking programs such as *Microsoft Windows 3.0* or *DeskView*.

The UART controls the flow of data through the serial I/O port—it moves data between the serial port and the CPU's parallel data bus. Normally, when a byte arrives at the PC from the modem, the UART signals the CPU with an interrupt. If the CPU is already answering a higher-priority interrupt, the CPU may not immediately respond to the incoming interrupt, causing the next inbound byte to overwrite the current byte. For most asynchronous file-transfer operations, this results in a check-sum error, with the entire data packet being retransmitted.

The new 16550A UART, a direct replacement for the other chips, solves the overrun problem by creating a first-in-first-out (FIFO) buffer stack. This lets the UART save incoming data until the CPU is ready to process it. But to initiate buffer operations, the 16550 needs communications software that can control its FIFO buffer.

QUITE COMPATIBLE

We didn't test every 2,400-bps modem against every other 2,400-bps modem, but we did test all of the products against Hayes's V-series Ultra Smartmodem 9600 and U.S. Robotics' Courier HST Dual Standard 9,600-bps modems. Both modems use the V.32 signaling scheme and are capable of using either the MNP 5 or V.42bis protocols. Unlike the 9,600-bps V.32/V.42/V.42bis modems tested in the earlier review, we found no compatibility problems in the 2,400-bps V.22bis set. When properly configured, all negotiated the fastest protocols available between each other. There was roughly a 1-second difference between the fastest and slowest handshaking sequence in our tests.

For overall reliability and compatibility with the rest of the world, V.22bis 2,400-bps modems are your best buy. If one of your main reasons for purchasing a modem is to use services like CompuServe and GENie, which don't yet use the V.32 modulation protocol but do support MNP 5, a V.22bis 2,400-bps modem using MNP 5 data compression will serve you

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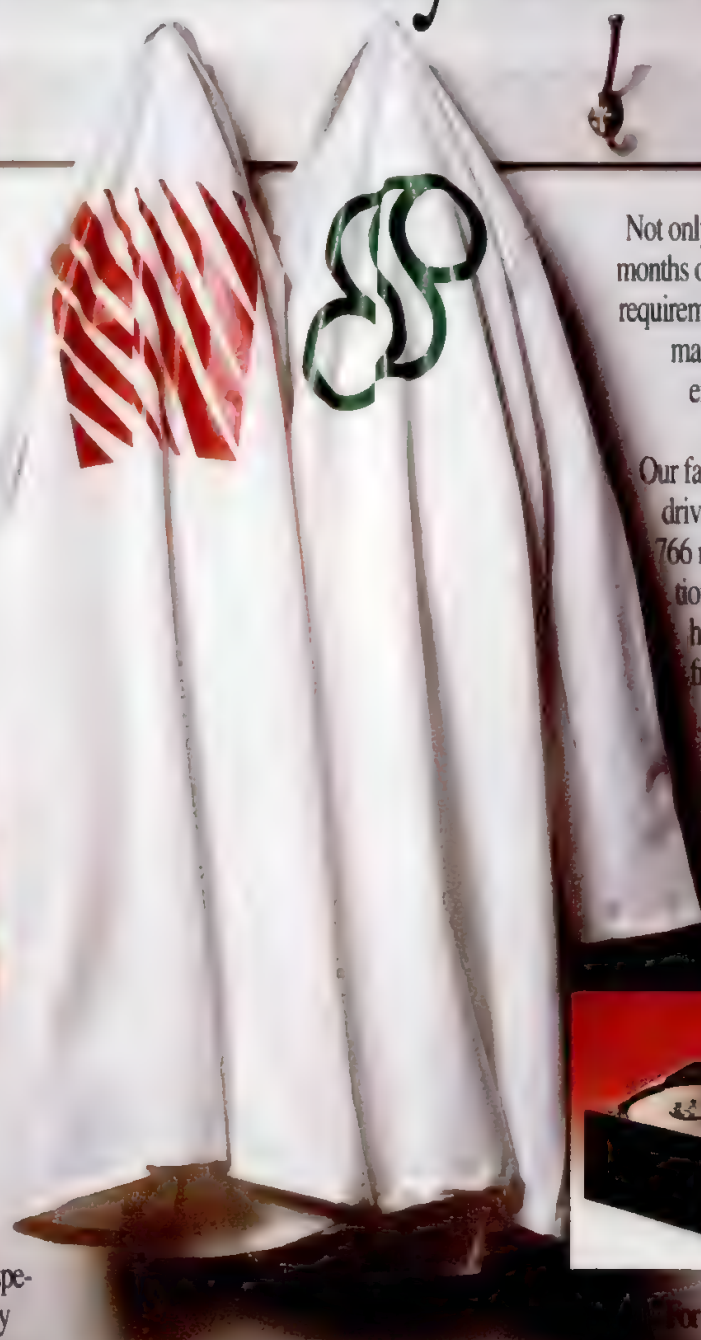
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CIRCLE 322 ON READER SERVICE CARD

nicely. The fact that all vendors who include V.42bis have also chosen to include MNP 5 means that the latter will be around for some years to come.

For some applications, the V.42bis protocol is clearly superior to MNP 5. Indeed, on-line services like CompuServe and Genie will likely soon support V.42bis. If you're thinking about the future, you should think about getting a 2,400-bps modem with not only MNP 5, but also V.42bis.

ACCTON TECHNOLOGY CORP.

Accton 2400MNP

by Mike Byrd

The Accton 2400MNP modem gives you plenty of action: full MNP 1 to 5 capabilities at 2,400 bps, along with both asynchronous and synchronous modes. The 2400MNP also supports dynamic packet-size adjustment to promote maximum data throughput under varying line conditions. This virtually problem-free device represents a solid buy; its \$299 price is about what you would expect for modems in its class.

The out-of-the-box setup is for non-MNP operations. To initialize MNP operations, you can alter the factory-default configuration via command-set instructions. The 2400MNP does not have a modem command-set instruction that specifically disables MNP 5 data compression for BBS operations. You can use the ATVL1 command to block the MNP link, but this also disables MNP 4 error control.

Accton Technology Corp. doesn't bundle a communications program with its package, so you'll have to provide your own. For normal asynchronous communication, you most likely will never need to touch the DIP switches; they are used primarily to configure the modem for connection to mainframes and minicomputers for synchronous operations. The user manual is thorough, but you will have to read several chapters just to understand how to reconfigure the modem from the factory default.

WELL-LABELED CASE

Accton's chip set comes from Rockwell and Toshiba. The white molded plastic unit measures 2 by 7 by 10.7 inches (HWD). All plugs, switches, and indica-

MNP CLASS 5: ENCODING TRICKS MOVE DATA QUICKLY

by Frank J. Derfler, Jr.

All of the modems we review here include Microcom's MNP Class 5 data compression protocol. MNP 5 uses two types of data compression algorithms to move certain kinds of files up to twice as fast as they would normally traverse a communications line if they were transmitted without any software or hardware compression protocols in place. These two techniques are Huffman encoding and run length encoding.

Huffman encoding takes advantage of the simple fact that some ASCII characters appear more frequently than others. In a typical data communications session without compression, each character is encoded using a 7- or 8-bit code. As shown in the table on the facing page, software following the Huffman encoding strategy sends the most frequently used letters in 4-bit groups; less frequently used characters are encoded by as many as 11 bits. Although less frequently used characters can require more bits than uncompressed characters, you still save time with Huffman encoding because the more frequently repeated characters are sent in fewer bits. (See Figure 1.)

When the file is transmitted, the compression software includes information on the length of the encoded character and then the encoded character itself. Because some characters are repeated so often, the data stream containing these common characters can be much shorter after compression than it would be using more typical ASCII encoding. (See Figure 2.)

The second type of compression used in MNP 5, run length encoding, takes advantage of the easy identification of a string of repetitive characters, including nonprinting characters like line feeds, carriage returns, and spaces.

When MNP 5 sees at least three of the same characters in a row, it uses run length encoding. It sends those charac-

ters and a repeat count that indicates the number of times those characters repeat. (See Figure 3.) Effectively handling repetitive characters provides excellent compression for certain types of files, such as spreadsheets, that have many repeated nonprinting characters used for formatting.

Some of the modems we review here allow you to disable MNP 5, an important feature when downloading compressed files from bulletin boards or transmitting files that have been previously compressed with programs like PKZIP or Lharc. When you're dealing with previously compressed files, if active, the MNP 5 protocol on the modem link will actually slow the throughput.

While Microcom does not include MNP 5 in the *Relay Gold* software, MagicSoft provides it in the *MTE* communications program, and Soft-Klone licenses it from MagicSoft as a \$39 add-in option to the *Mirror* program. MNP 5 software provides data compression and error handling on the entire link, including the segment between each PC's serial port and attached modem. Other protocols like XModem and ZModem have proven more popular than MNP 5 because they automate the task of transferring files.

Microcom recently enhanced its data compression technique with the introduction of MNP 7, which encodes characters according to the frequency of character pairs. While MNP 5 provides a 2-to-1 compression ratio for some types of files, MNP 7's compression ratio for similar files is 3 to 1. This means that a modem with a modulation rate of 2,400 bps could provide a throughput of up to 7,200 bps, if it's connected to a high-speed serial port. The Lempel Ziv algorithm used in V.42bis is still more efficient than MNP 7 with certain types of files. Microcom has also implemented V.42bis in its products. ■

MNP 5 Data Compression Encoding Table

Frequency	8-bit pattern	Coded number of bits
Most frequent	E	4
	T	4
	S	4
	A	4
	I	5
	L	5
	.	.
	.	.
	X	9
	Y	10
Least frequent	Z	11

Figure 1: The numbers in this chart are not fixed—that is, the letter E does not equal 4 for every operation. MNP 5 starts not knowing anything about the data; it learns about the frequency of the characters as it goes and continually updates its compression table. For example, if Y started showing up as often as A, Y would move closer to the top of the table: It would be encoded by fewer than 10 bits.

Compression Technique (Huffman Encoding)

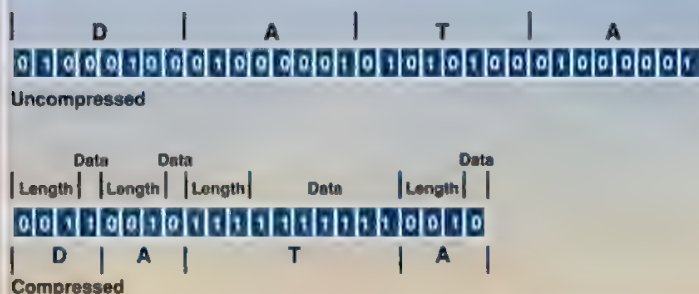


Figure 2: Assume in this case that the letter A is the most frequently sent character, the letter D is the second most frequently sent character, and the letter T is the least frequently sent character.

Compression Technique (Run Length Encoding)

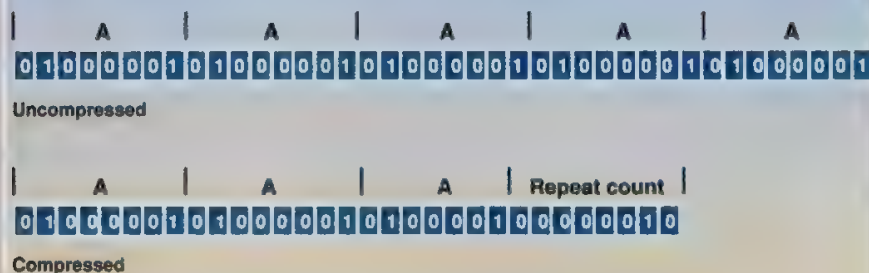


Figure 3: Assume that the letter A is to be sent five times.

Source of charts: Microcom Inc.

FACT FILE

Accton 2400MNP
Accton Technology Corp., 46750 Fremont Blvd., #104, Fremont, CA 94538; 800-926-9288, 415-226-9800.
List Price: \$299.
Requires: RS-232 cable, communications software.
In Short: The Accton 2400MNP offers connectivity with all modems, even those without error correction. Its synchronous operation allows connection to mainframes or minicomputers. A solid buy that includes a voice/data switch, this modem can be set up and operated without problems.

CIRCLE #02 ON READER SERVICE CARD

tors are well marked. The rear panel includes an RS-232C port, a power socket, two banks of eight DIP switches each, and two RJ-11 jacks. The modem also provides a speaker volume control, but you need a screwdriver to adjust it.

The front panel contains eight LED indicators and three switches. The modem lacks a true on/off switch, but it includes a push-button reset switch with effects equivalent to unplugging and replugging the device. Another switch allows control between data and voice modes. The third push-button switch controls when the modem goes off-hook in originate or answer mode.

There are LED indicators for power, speed, carrier detect, error, terminal ready, off-hook, transmit data, and receive data. The speed indicator is off for 300-bps operations, red for 1,200 bps, and green for 2,400 bps. The error light flashes briefly when the modem corrects a communications error, retrains, or encounters a system error.

Accton's modem didn't present us with any problems during setup or operation, and it provided solid midrange performance on our Compressible Data File throughput test. All told, it represents a good buy in the modem market, complete with a two-year limited warranty and unlimited technical support through a toll number and the company's BBS.

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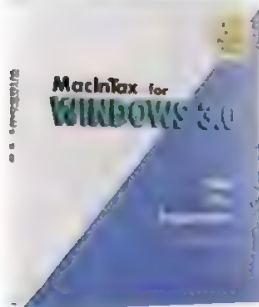
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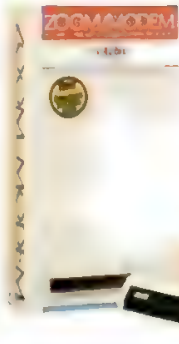
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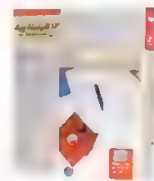
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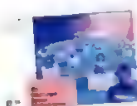


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ANCHOR AUTOMATION INC.

Anchor Modem 24E5

by Kimberly Maxwell and
R. Dennis Boatner

Anchor Automation uses state-of-the-art technology (in the form of a CMOS low-power-consumption chip) to help reduce the amount of heat emitted from its modems. Its Anchor Modem 24E5, measuring at 1.2 by 6 by 9 inches and selling for \$299, also uses Intel's chip set and supports MNP 1 to 5. Anchor also offers an internal version of its modem on a half-length card for \$219.

The external Anchor 24E5 we reviewed comes with an RJ-11 cable and a power adapter. As with most of the modems, you'll need to purchase an RS-232 cable to plug into the modem's 25-pin connector. The RS-232 cable for the Anchor 24E5 (and for all modems, for that matter) must be wired straight through. That is, the wires going from the number two and number three pins in each plug must not swap, as they do in a null-modem cable. On each end of the cable, pin two must connect to pin two, and pin three to pin three. You'll need a cable with a full complement of nine wires.

The back panel, which is poorly marked, holds two RJ-11 jacks and the power-adaptor jack. The front panel con-

sists of eight indicator lights set into a flat front panel, making them easy to see.

You'll need to purchase communications software separately, as the Anchor 24E5 does not come with any. It does have the benefit of being listed in the opening modem-support menus of popular communications programs like *Crosstalk*, *HyperAccess/5*, and *ProComm Plus*.

STORING CONFIGURATIONS

The modem is preset to negotiate the highest level with the remote modem. The Anchor 24E5 lacks a hardware volume control, but you can control its speaker volume through Hayes AT commands. If you need to store configurations, it's easily done using the &W command; this stores the S registers in the modem's nonvolatile memory. Up to four phone numbers can also be stored on-board.

The Fastest Small Business LAN Is Invisible.



Anchor Modem 24E5

Anchor Automation Inc., 20675 Bahama St.,
Chatsworth, CA 91311; 818-998-6100.

List Price: \$299.

Requires: RS-232 cable, communications
software.

In Short: State-of-the-art CMOS technology lets
Anchor offer a modem with low power
consumption. The device supports MNP 1 to 5
and is featured in the menus of communications
programs like *Crosstalk*, *HyperAccess/5*, and
ProComm Plus. But in a market where most of its
competitors get an FCC Class B rating, it gets
only a Class A.

CIRCLE 003 ON READER SERVICE CARD

The documentation doesn't skimp on the information you'll need for the modem's installation. Anchor also supplies a long, five-year warranty on parts and labor. If you need assistance, free technical support is available on a toll telephone line.

In terms of performance, the modem fell into the midrange on our Compressible Data File throughput test. While that is quite acceptable, less welcome is the de-

vice's FCC Class A rating: Most of the other modems we reviewed are Class B. The plastic case is sturdy enough to hold any telephone and to survive a drop from a table to a hard floor, but it doesn't present the feeling of quality you get from competing modems with metal cases.

The Anchor 24E5 is a little pricey for what it offers, but with its special low-

power-consumption chip, it is an acceptable choice for users looking for a device that can take the heat.

ATI TECHNOLOGIES INC.

ATI 2400etc/e

by M. Keith Thompson

Best known for its excellent VGA cards, ATI Technologies also offers a well-made V.22bis, 2,400-bps modem for \$299. The ATI 2400etc/e is a good buy, offering not only MNP 5 capabilities but also V.42 error control and V.42bis data compression.

The 2400etc/e uses a proprietary ATI chip set. The modem's appearance is both pleasing and modern. Molded of high-impact gray plastic, the unit measures 1.5 by 6 by 9 inches. On the front panel, 12 LEDs display the status of the various functions and 5 touch-sensitive switches control them. Unlike many modems, the 2400etc/e includes an EC light that informs you when the modem negotiates an error-correcting connection.

The product lets you easily adjust the speaker volume with a slide switch on the front of the right side, but not with software commands. At the back are clearly marked phone and line jacks, along with the power switch and RS-232 connector.



As it should be. A LAN's moment of truth is its ability to access data fast while remaining invisible, easy to use. And it should take up little, if any, of your DOS memory. So there'll be plenty available for processing tasks.

With speed in mind, we designed new super-swift Net/30 2.0 software. How fast is it? At least 30% faster than our nearest competitor. And about 60% faster than the rest of the pack.

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Invisible Software, Inc.
1142 Chess Drive
Foster City, CA 94404
FAX 415-570-6017

CIRCLE 228 ON READER SERVICE CARD

You can easily adjust
the speaker volume of
the ATI 2400etc/e with
a slide switch on the
front.

PUSH-BUTTON FUNCTIONALITY

The front panel switches allow you to control some functions of the modem manually. The voice/data switch lets you talk to the person to whom you just transferred a file—without making another phone call. Users at both ends have to switch from data to voice mode, but not necessarily at the same moment. Pressing the test switch starts a modem self-test. The speed button sets the modem's transmission rate, indi-

COMMUNICATIONS

2,400-bps Modems

cated with colored LEDs, at 300, 1,200, or 2,400 bits per second. Other buttons put the modem in auto-answer or synchronous mode.

The 2400etc/e comes with three different factory-configuration options. The default configuration sets the modem for basic asynchronous communication, without error correction or data compression. The &F1 command restores MNP 5 operation; the &F2 mode sets it to recognize and negotiate with V.42bis and all other modes. The 2400etc/e also provides for two user-defined configuration profiles and lets you force an error-correcting connection to accommodate bad phone lines. The above-average documentation helps you set these functions.

ATI ON THE MENU

While no communications programs come bundled with the unit, both *HyperAccess/5* and *Relay Gold*, Version 4, do support the ATI 2400etc/e on their modem-installation menus. If the ATI isn't on the menu of your own comm software, have no fear; you can easily set it up as a Hayes compatible.

The 2400etc/e initially interrupted our file-transfer tests and had to be reset, but it completed several retests without a problem. The modem proved to be one of the fastest units we tested when using the V.42bis protocol, although its scores using the MNP 5 protocol ranked near the bottom of the pack.

ATI provides free technical support at a

toll number and through its BBS, along with a two-year limited parts-and-labor warranty. 2400etc/e customers who bought the modem before V.42bis was implemented can upgrade for \$40. This easy-to-use modem with V.42bis data compression offers valuable features at a very reasonable price.

BEST DATA PRODUCTS INC.

Smart One 2400XMNP

by Kimberly Maxwell

Competitively priced at \$249, Best Data's Smart One 2400XMNP modem uses the Intel chip set and, at 1.5 by 6.5 by 9.5 inches, fits perfectly under the telephone on your desk. The modem's appealing design offers eight front-panel indicator lights, including a high-speed light for connections at 2,400 bps. The well-marked back panel contains the on/off switch and two RJ-11 jacks. The case is heavy plastic; the product doesn't have the hollow sound of some of its lighter competitors.

The physical feature lacking in this modem is a hardware volume control, but you can adjust the volume via a Hayes AT command. Additionally, the Smart One offers out-of-the-box MNP 1 to 5 operation. You can program one configuration setting and store it in nonvolatile memory. Nonvolatile memory can also store up to four phone numbers.

SOFTWARE INCLUDED

The Smart One is one of the few external modems we reviewed that includes a communications program. The program is Smith Microsoftware's *Quicklink II*, a serviceable offering often packaged with internal modems.

The Smart One initially gave us some problems by aborting file transfers during our testing. We went through several pairs of modems before the company finally delivered models that could pass all of our performance tests. The company claimed that the problems arose because the modems required a later version of the Intel chip set. Whatever the reason, we were happy to find that the last pair we received



FACT FILE

Smart One 2400XMNP
 Best Data Products Inc., 9304 Deering Ave.,
 Chatsworth, CA 91311; 818-773-9600.
List Price: \$249.
Requires: RS-232 cable.
In Short: A sleek look and a moderate price distinguish the Smart One 2400XMNP, as does the inclusion of communications software, rare among these external modems. The well-designed manual neatly summarizes commands and configuration registers and offers some valuable troubleshooting tips.

CIRCLE 605 ON READER SERVICE CARD

exhibited no operational problems, achieving average throughput scores on the Compressible Data File throughput test.

The manual may be one of the best-executed features of this package. It contains a good summary of commands and configuration registers, an adequate troubleshooting section, and visually interesting extras like an illustration of the loopback tests the modem performs at power-up time. If that's not enough to help you out of any problem you may encounter with the Smart One, free technical support is available at a toll number. Best Data also supplies a two-year warranty on parts and labor.

If you want a moderately priced modem with a sleek look and you like the idea of getting communications software in the bargain, the Smart One 2400XMNP may be worth your consideration.

CARDINAL TECHNOLOGIES INC.

Cardinal 2400MNP

by Mike Byrd

Cardinal Technologies markets the American-made Cardinal 2400MNP, featuring MNP class 1 to 4 error control and class 5 data compression, for \$299. The modem is made with high-quality parts but accompanied by sparse documentation. An internal

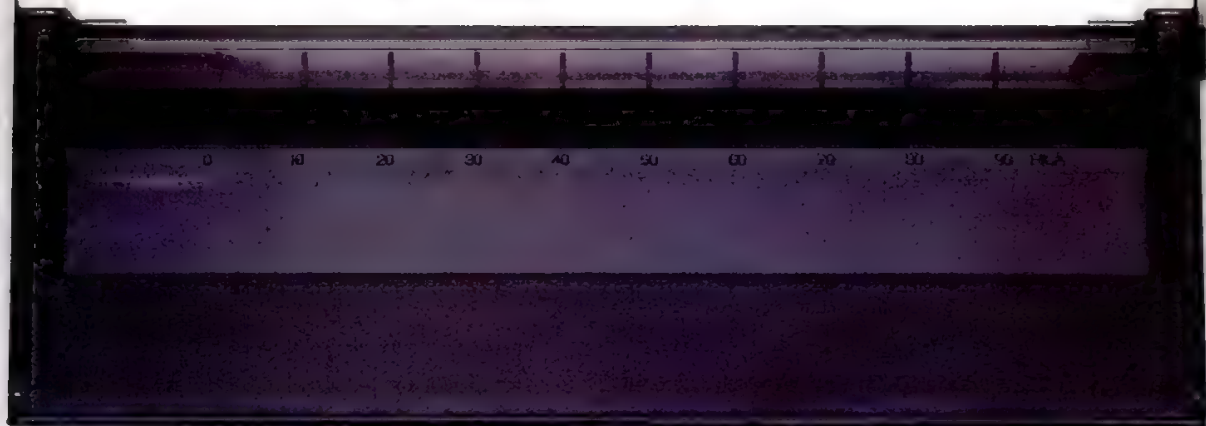


FACT FILE

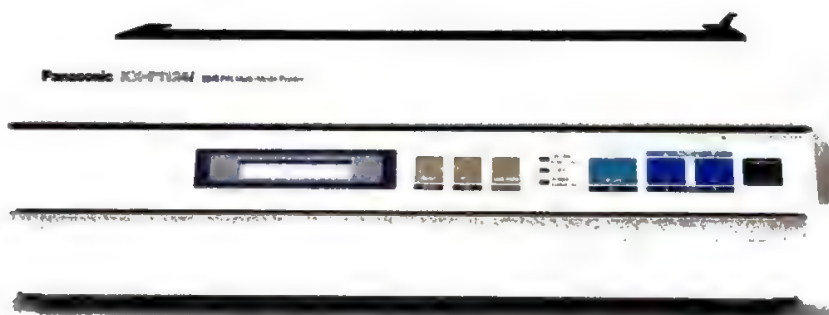
ATI 2400etc/e
 ATI Technologies Inc., 3761 Victoria Park Ave.,
 Scarborough, Ontario M1W 3S2, Canada; 416-756-0711
List Price: \$299.
Requires: RS-232 cable, communications software.
In Short: Good design, extra functionality, and V.42bis data compression give the ATI 2400etc/e a competitive edge. It includes all of the features you would expect in an expensive modem, but at a very reasonable price.

CIRCLE 604 ON READER SERVICE CARD

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The Panasonic KX-P1124 has probably won more awards than any other dot matrix 24-pin printer in history. The KX-P1124*i* represents a significant improvement.

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That, too, is the Panasonic way. And the reason why our strongest impression is value. For further information on the KX-P1124*i*, and the name of the dealer nearest you, call **1-800-742-8086**.

* Based on US dollar market share of competitive models for the 12 months ending December, 1990, as reported by InfoCorp (1/91)

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COMMUNICATIONS

2,400-bps Modems



2,400-BPS MODEMS: SUMMARY OF FEATURES

Products listed in ascending price order

	Computer Friends Inc. Lightspeed 2400LE	Supra Corp. SupraModem 2400MNP	Best Data Products Inc. Smart One 2400XMNP	Longshine Technology Inc. Longshine LCS-8824 MNP 5	Micro Integrated Communications Corp. MICC 4824/SA	Accton Technology Corp. Accton 2400MNP
List price	\$199.00	\$199.95	\$249.00	\$259.00	\$295.00	\$299.00
GENERAL FEATURES						
Chip set	EXAR	Intel	Intel	EXAR	EXAR	Rockwell, Toshiba
Uses DIP switches	☐	☐	☐	☒	☒	☒
Data/voice switch	☒	☐	☐	☐	☐	☒
Volume of on-board speaker controlled by hardware or software	Both	Software	Software	Hardware	Neither	Hardware
Number of phone numbers stored on-board	2	4	4	4	1	9
Communications program included	☒	☐	☒	☐	☐	☐
Configurations stored in memory	1	2	1	2	1	4
Supports synchronous mode	☒	☒	☒	☐	☒	☒
Warranty	2 years	5 years	2 years	1 year	2 years	2 years
FLOW CONTROL						
XON/XOFF	☒	☒	☒	☒	☒	☒
RTS/CTS	☒	☒	☒	☒	☒	☒
MODULATION PROTOCOLS						
Bell 103/113	☒	☒	☒	☒	☒	☒
V.21	☐	☒	☒	☐	☒	☒
Bell 212A	☒	☒	☒	☒	☒	☒
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Local analog loopback	☒	☒	☒	☒	☒	☒
Local digital loopback	☒	☒	☒	☒	☒	☒
Remote analog loopback	☒	☒	☐	☐	☐	☐
Remote digital loopback	☒	☒	☐	☒	☒	☒
Test pattern generation and checking	☐	☒	☐	☒	☒	☒
Power-on self-test	☒	☒	☒	☐	☒	☒
INSTALLATION OPTIONS						
Remote access, control, or diagnostics	☐	☒	☒	☐	☐	☐
Auto-dial capability	☒	☒	☒	☒	☒	☒
AT COMMANDS						
Accepts both uppercase and lowercase input	☒	☒	☒	☒	☒	☒
Accepts mixed uppercase and lowercase input	☒	☒	☒	☒	☒	☒
Hayes model that most closely resembles the unit's AT command set	Smartmodem 1200	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400	Smartmodem 2400
Command to turn off MNP 5	☒	☒	☒	☒	☒	☐
ERROR CONTROL AND DATA COMPRESSION						
Error control protocols	MNP 2 to 4	MNP 2 to 4	MNP 1 to 4	MNP 2 to 4	MNP 2 to 4, V.42	MNP 1 to 4
Data compression protocols	MNP 5	MNP 5	MNP 5	MNP 5	MNP 5	MNP 5

☒—Editors' Choice ☒—Yes ☐—No

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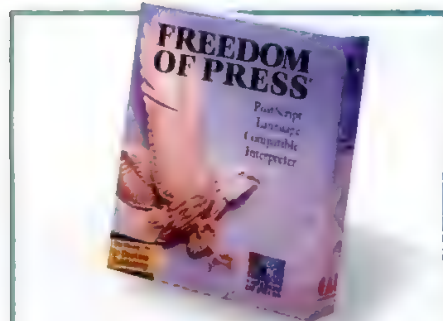
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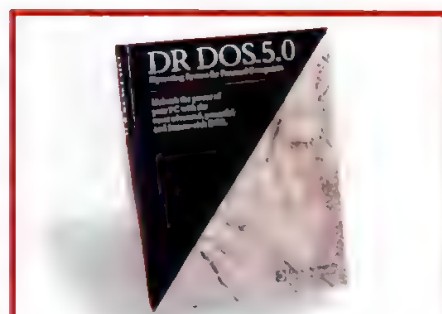
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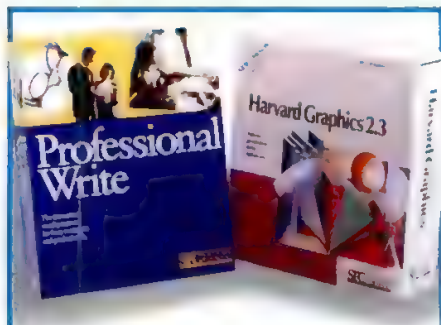
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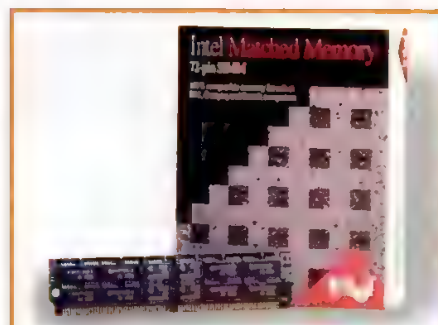


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8874 CP3184 80 Meg IDE HD (25 ms) .. 499.
8876 CP3104 100 Meg IDE HD (25 ms). 549.

IOMEGA ... 1 year

- 5116 Bernoulli II 44 Meg Internal 995.
7551 Bernoulli II Transportable 44 Meg . 997.
5113 44 Meg Cartridge Tripak (5 1/4") . . 249.
2500 PC2B Controller 229.

Mountain Computer ... 2 years

- 2917 40-60 Meg Internal Tape Drive ... 259.
5500 80-152M Int. Tape Drive 629.
5190 DC2000 Pre-formatted Cartridges ea. 35.
6153 DC2120 Tape Cartridge (5 pack) .. 149.

Pacific Rim ... 1 year

- 5010 1.2 Meg External (for PS/2's) 215.
6602 1.44 Meg External (for PC/XT/AT) . 239.

Plus Development ... 2 years

- 6424 Hardcard II 80 Meg (19 ms) 599.
8304 Hardcard II XL 50 Meg (9 ms) ... 399.
8287 Hardcard II XL 105 Meg (9 ms) ... 689.

Seagate ... 1 year

- 2285 20 Meg Int. Hard Drive ST225 (w/controller and cables, 65 ms) .. 255.
2286 30 Meg Int. Hard Drive ST238R (w/controller and cables, 65 ms) .. 269.
4554 40 Meg Int. HD ST251-1 (28 ms) .. 329.

TEAC ... 1 year

- 4670 1.44 Meg Drive for PC/XT (3 1/2") . \$89.
4326 1.44 Meg Drive for AT (3 1/2") with Bastech software. 109.
4951 720k Drive for PC/XT (3 1/2") 75.
6951 1.2 Meg Drive for AT (5 1/4") 99.

DISKS/MEDIA

Maxell ... lifetime

- 2789 5 1/4" MD2-D 360k Disks (Qty. 10) 10.
2792 3 1/2" DS/DD 720k Diskettes (Qty. 10) . 13.
2793 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 21.



Canon ... 1 year

7894 BJ-10e Bubblejet Printer—Light weight, excellent print quality and a great price make this 4.6 lb. printer a winner. Choice of black or white. Optional sheet feeder \$349.



TIMESLIPS ... NCP

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- 3291 5 1/4" DS/DD 360k Disks (Qty. 10) 9.
3297 3 1/2" DS/DD 720k Diskettes (Qty. 10) . 12.
3298 3 1/2" DS/HD 1.44Mb Diskettes (Qty. 10) 19.
6148 3 1/2" DS/DD (3 Pack) 29.
6375 3 1/2" DS/HD (3 Pack) 49.
8185 QD 2040 Tape Cartridge 19.
6712 QD 600A Tape Cartridge 27.
6715 QD 6150 Tape Cartridge 27.

3M ... lifetime

- 3943 DC 2000 Tape Cartridge 20.
6065 DC 2080 Tape Cartridge 25.
3944 DC 600 Tape Cartridge 29.
5679 DC 6150 Tape Cartridge 29.

MEMORY

- 6556 256k DRAM (100 ns, set of 9) call
5510 1 Meg x 9 SIMMs (80 nanosecond) call
5746 1 Meg Chips (80 ns, set of 9) call
7813 256k x 4 Chips call

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Hayes



Hayes ... 2 years

8049 JT Fax 9600B—Good, solid fax board from the company who wrote the book on communications. TSR fax software, print capture, and one-step convert and send are just a few of the features \$379.

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Note: Accounts on net terms pay actual shipping.

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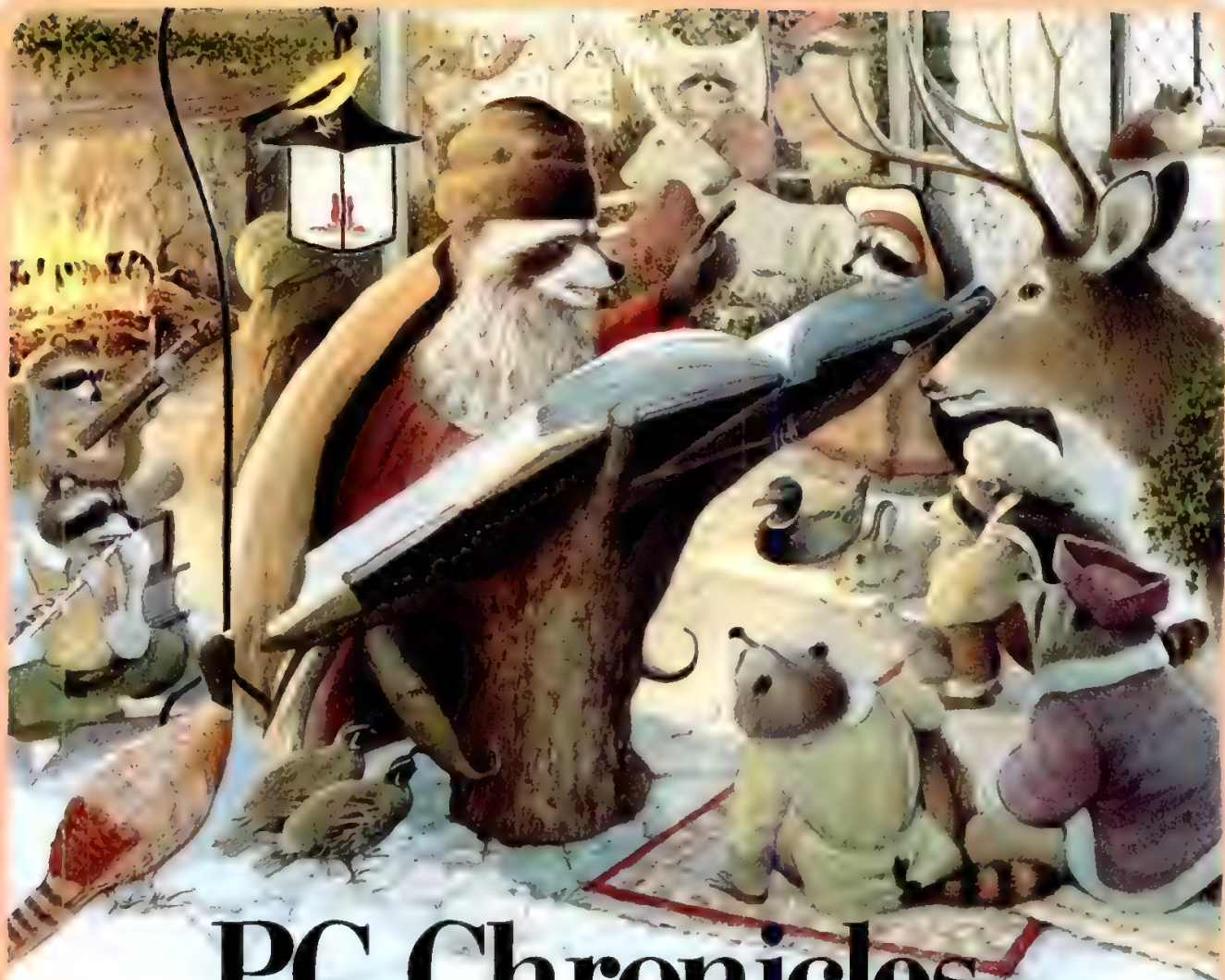
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PC Chronicles.

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(Or, how we wrote the book on PC mail order.)

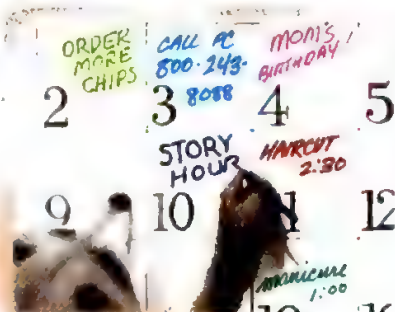
Truth tends to be stranger than fiction in the telltail town of Marlow, NH (pop. 564). That's why you'll often find the local color gathered 'round the ancient sage as he recounts in vivid detail how our forest glade was transformed into a PC paradise.

For, in days of yore, buying software and peripherals by mail was a perilous task, fraught with danger and uncertainty. Only those well versed in the black arts dared risk such unpredictable delivery and uncertain compatibility.

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COMMUNICATIONS

2,400-bps Modems

2,400-BPS MODEMS: SUMMARY OF FEATURES

Products listed in ascending price order



	Practical Peripherals Inc. Practical Modem 2400SA MNP	Prometheus Products Inc. ProModem 2400 Plus	U.S. Robotics Inc. Sportster 2400 MNP	Zoom Telephonics Inc. Zoom/ Modem V.42bis	Intel Corp. Intel 2400EX MNP	Hayes Microcomputer Products Inc. V-series Smartmodem 2400 V.42/X.25	Microcom Inc. Microcom QX/2400t
List price	\$299.00	\$299.00	\$299.00	\$299.00	\$349.00	\$649.00	\$699.00
GENERAL FEATURES							
Chip set	Rockwell	Intel	SSI	Rockwell	Intel	Hayes	Sharp
Uses DIP switches	☐	☐	☒	☐	☐	☐	☒
Data/voice switch	☐	☐	☐	☐	☐	☐	☒
Volume of on-board speaker controlled by hardware or software	Software	Both	Software	Software	Software	Software	Hardware
Number of phone numbers stored on-board	4	3	1	4	4	4	9
Communications program included	☐	☐	☐	☐	☒	☐	☐
Configurations stored in memory	2	2	1	2	2	3	1
Supports synchronous mode	☐	☒	☐	☒	☐	☒	☒
Warranty	5 years	2 years	2 years	2 years	5 years	2 years	1 year
FLOW CONTROL							
XON/XOFF	☒	☒	☒	☒	☒	☒	☒
RTS/CTS	☒	☒	☒	☒	☒	☒	☒
MODULATION PROTOCOLS							
Bell 103/113	☒	☒	☒	☒	☒	☒	☒
V.21	☐	☒	☐	☒	☒	☒	☐
Bell 212A	☒	☒	☒	☒	☒	☒	☒
SELF-TESTS							
Local analog loopback	☐	☒	☒	☒	☒	☒	☒
Local digital loopback	☐	☒	☒	☒	☒	☒	☒
Remote analog loopback	☐	☒	☒	☒	☒	☒	☒
Remote digital loopback	☐	☒	☒	☒	☒	☒	☒
Test pattern generation and checking	☐	☒	☒	☒	☒	☒	☐
Power-on self-test	☐	☒	☒	☒	☒	☒	☒
INSTALLATION OPTIONS							
Remote access, control, or diagnostics	☐	☐	☐	☐	☒	☐	☒
Auto-dial capability	☒	☒	☒	☒	☒	☒	☒
AT COMMANDS							
Accepts both uppercase and lowercase input	☒	☒	☒	☒	☒	☒	☒
Accepts mixed uppercase and lowercase input	☐	☒	☒	☒	☒	☒	☒
Hayes model that most closely resembles the unit's AT command set	Smartmodem 2400	Smartmodem 2400	SmartModem 2400	Ultra 96	Smartmodem 2400	Hayes V-series	Ultra 96
Command to turn off MNP 5	☒	☒	☒	☒	☒	☒	☒
ERROR CONTROL AND DATA COMPRESSION							
Error control protocols	MNP 1 to 4	MNP 2 to 4	MNP 2 to 4	MNP 2 to 4, V.42	MNP 4	MNP 4, V.42, LAPB	MNP 2 to 4
Data compression protocols	MNP 5	MNP 5	MNP 5	MNP 5, V.42bis	MNP 5	MNP 5, V.42bis, Hayes Adaptive Data Compression	MNP 5, 7

—Editors' Choice ☒—Yes ☐—No

ENDS

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Image Capture Boards: AT&T

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Call for additional information including a complete list of supported hardware.

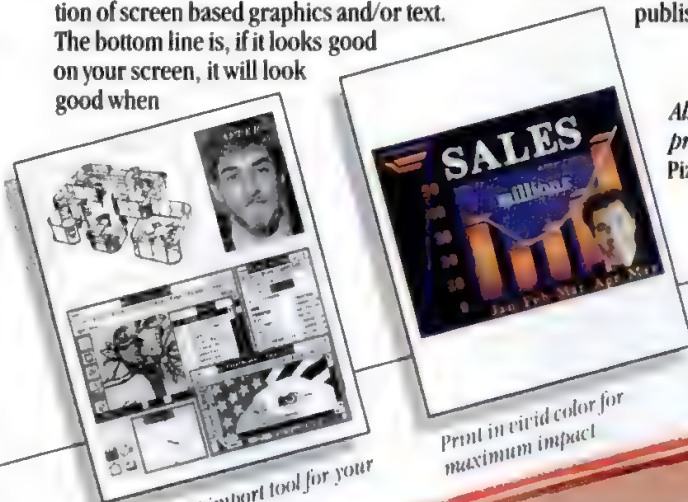
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Memory resident program takes as little as 32K. All manufacturer's names or product names are registered trademarks of their respective manufacturer. Screen images courtesy of AT&T and Facet, Inc.



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CIRCLE 335 ON READER SERVICE CARD

version of the product, the Cardinal 2450MNP, costs \$279 and includes a bundled communications package, Cardinal's proprietary *Flashlink*.

The Cardinal 2400MNP uses an Intel chip set. It comes ready to operate in a rugged 1.5- by 5.5- by 9.6-inch aluminum case with a black plastic front and a well-marked rear panel. The rear panel includes the power switch and two RJ-11 jacks, for the wall plug and a telephone. An internal speaker allows call-connection monitoring, but the modem lacks a manual volume control. The software volume control works adequately.

The front panel contains eight LED status indicators. They show modem ready, modem test, terminal ready, send data, receive data, off-hook, carrier detect, auto-answer, and high-speed (2,400-bps) operations.

SOFTWARE-ONLY CONFIGURATION

There are no LED indications of active MNP error control or data compression operations, nor internal DIP switches to set modem parameters such as flow-control options or MNP operations. You configure these parameters in software.

The default configuration does not set up the modem for MNP 5 operation, but the manual gives specific examples of how to set up most communications programs for MNP. In general, you select either 2400 Generic or Hayes 2400 from the menu and modify the modem initialization string according to instructions. Both

Flashlink and MagicSoft's *MTEZ* already include the Cardinal modem on their setup menus.

The short manual contains instructions on installation and configuration of your modem, but the contents and details are sparse and poorly organized. Flipping back and forth between pages to understand how to configure the unit becomes annoying.

The Cardinal 2400MNP has only a one-year warranty, but technical support is free and unlimited through a toll-free number or through a bulletin board that Cardinal maintains. In terms of performance, the Cardinal ranks squarely in the midrange on our Compressible Data File throughput test. If you don't mind drifting through a poorly arranged manual, the Cardinal is an acceptable choice.

COMPUTER FRIENDS INC.

LightSpeed 2400LE

by Lisa Cady Newell

The LightSpeed 2400LE from Computer Friends is a true workhorse of a modem. And at \$199, it's a terrific value for the non-nonsense user, since it doesn't require any further purchases. It is, in fact, the only modem we reviewed that includes an RS-232 cable.

The 1.4- by 5.4- by 10-inch modem comes bundled with *QuickLink II* software and all the cables you'll need to get started. Large enough to accommodate a standard-size telephone, the LightSpeed offers the user concerned with aesthetics a sleek, pleasantly competent design featuring a front-panel display with eight easy-to-see LEDs. The LEDs indicate signs of transmission status such as whether auto-answer is enabled and whether the telephone line is off-hook.

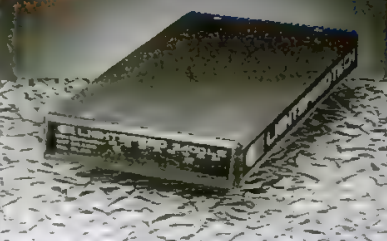
On the rear panel, you'll find two RJ-11 jacks and an on/off switch. The volume control, located between the RS-232 port and power supply outlet, is a little difficult to reach but sometimes a relief to have at all. You can also adjust the volume with software commands.

COMPLETE MODEM DIAGNOSIS

The LightSpeed uses an EXAR chip set and works in synchronous and asynchro-



FACT FILE



LightSpeed 2400LE
Computer Friends Inc., 14250 NW Science Park Dr., Portland, OR 97229; 800-547-3303, 503-626-2291.
List Price: \$199.
In Short: The LightSpeed 2400LE delivers solid low-cost performance. Despite the low price, the package includes the cables and software to get you started; in fact, it's the only product we reviewed that came with an RS-232 cable.

CIRCLE 607 ON READER SERVICE CARD



FACT FILE



Cardinal 2400MNP
Cardinal Technologies Inc., 1827 Freedom Rd., Lancaster, PA 17601; 800-722-0094, 717-293-3000.
List Price: \$299.
Requires: RS-232 cable, communications software.
In Short: Cardinal provides 2,400-bps modem with quality parts and MNP 1 to 5 but no outstanding features. Software-configurable only, it lacks DIP switches to set modem parameters such as flow control options or MNP operations.

CIRCLE 606 ON READER SERVICE CARD

nous modes. It provides some of Hayes's extensions to its Standard AT Command Set. The command AT\S, for example, gives you a display of all S registers plus some additional settings. Typing AT\S gives you a fairly complete status report of what's going on inside the modem. Although it's not particularly critical that you know the information that is provided by all the S registers, this function may come in handy if you run into a problem down the road.

We didn't find the LightSpeed 2400LE listed as a specific installation option on the setup menu of any communications program, but if the program includes Hayes as a menu selection, you can choose it as the default. Our tests of the LightSpeed went smoothly, allowing us to send and receive compressed data at an average, adequate speed on the first try.

No toll-free number is available for support, but with a modem as solid as this one, you may never need to call the company. Careful reading of the clear and concise documentation should steer you away from most pitfalls. Just in case, you also get a two-year limited warranty from the company.

Few V.22bis MNP 5 modems at this price offer extras such as an RS-232 cable and bundled communications software. These extras coupled with good performance make the LightSpeed 2400LE a reliable and attractive choice at an affordable price.

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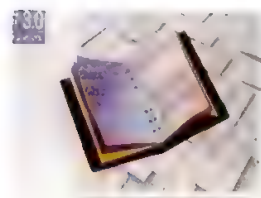
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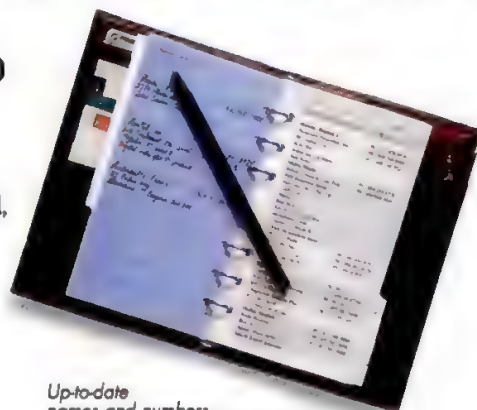
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COMMUNICATIONS

2,400-bps Modems

COMPUTER PERIPHERALS INC.

ViVa 24m

by Lisa Cady Newell

The ViVa 24m is certainly the most stylish modem we reviewed. The \$299 unit's upright tower design conveniently saves valuable desktop space, while its faux granite base, coupled with its nifty icons, make it attractive enough for the most sophisticated office. The ViVa is not the least expensive modem in the pack, but its thoughtful selection of features makes it worth a second look.

The ViVa 24m, operating with a chip set made by Sierra, supports synchronous and asynchronous communication. The external version we tested measures 5.4 by 2.1 by 5.7 inches. Computer Peripherals also markets an internal version, the ViVa 24im, identically priced at \$299.

COOLING DESIGN

The external version of the modem features a natural convection airflow system. Air enters between the modem and its bracket and flows over the boards, making

the ViVa 24m cool to the touch, even after prolonged use.

The ViVa represents thoughtful design in other ways: Its icons may presage the fu-



ture for modems. Their user-friendly and decorative appearance, with a rabbit icon to designate high-speed mode and a phone icon to show whether the modem is off-hook, gives this device a low-tech look that may make users feel more comfortable. Other icons accompany LEDs to indicate auto-answer, carrier detect, receive data, send data, terminal ready, and modem ready.

The power switch on the front of the modem eliminates needless fumbling when you need to disconnect immediately. The back includes two RJ-11 jacks.

One feature missing on the ViVa 24m is a manual volume control. The software volume adjustment listed in the documentation didn't initially respond to our commands. When it worked, the audio quality was very tinny.

PRESET SOFTWARE

The modem uses the Hayes Standard AT Command Set. At present, no communications programs list the ViVa 24m on their installation menus, but you can treat it as a Hayes modem for setup purposes. The package includes *QuickLink II* communications software preset for the ViVa 24m,



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So how quick is quick? With V.42bis, data can be compressed up to 400 percent, increasing throughput to as much as 38.4Kbps. Which means it keeps its telephone conversations short and saves you money on your phone bills. And while it communicates

quickly, it also communicates clearly. The 9600EX knows when data is being garbled and automatically retransmits, so your data arrives error free.

Plus, the 9600EX features full-compliance with V.32 and is downward-compatible with slower modems. And, like our entire family of modems, the 9600EX comes with a full, five-year warranty.

COMMUNICATIONS

2,400-bps Modems

which eases installation.

The manual is easy to understand, but it contains no index for quick reference. If you need technical support, it's available at a toll-free number.

The ViVa 24m fills a niche in the modem marketplace with its stylish design. Unfortunately, its speed doesn't quite match its good looks; it came in very near the bottom of the pack on our Compressible Data File throughput test. Still, if service is a greater priority for you than speed, the ViVa's five-year limited warranty helps assure that you won't be disappointed by your purchase.

EVEREX SYSTEMS INC.

Evercom 24E Plus

by Lisa Cady Newell

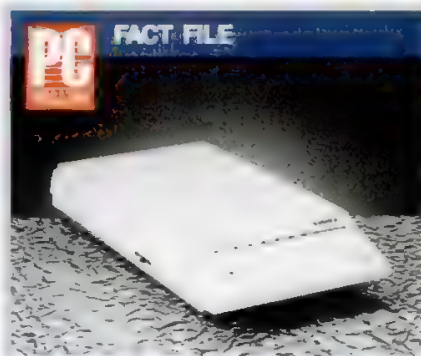
Everex Systems' Evercom 24E Plus is one of the few modems offering interchangeable data and voice communications. While the company promotes the ability to switch between data and voice, we were far more impressed with the modem's abil-

ity to convert a standard phone into a speakerphone during regular voice calls. In any case, the \$299 Evercom 24E Plus proves a solid performer, scoring good if not awe-inspiring numbers on our Compressible Data File throughput test.

SSI makes the Evercom's chip set. The modem stores up to four phone numbers in memory, complete with dial command modifiers. The unit comes with *Bitcom* software and a diagnostics disk to test the PC, the local and remote modems, and the telephone circuit. An internal version, the Evercom 24 Plus, lists for \$249. The external version we reviewed measures 2 by 6.7 by 12 inches, large enough to hold a standard telephone.

The modem's metal base gives it a substantial look. Its sloping front panel allows easy access to the controls, but the 11 tiny triangular LED lights are difficult to see from most angles. The LEDs include the standard indications of readiness, speed, and carrier, but they also show when MNP is active, when the line is off-hook, and when the speakerphone is muted.

The front panel includes a convenient



Evercom 24E Plus

Everex Systems Inc., 48431 Milmont Dr., Fremont, CA 94538; 800-821-0806, 415-498-1111.

List Price: \$299.

Requires: RS-232 cable.

In Short: The Evercom 24E Plus is a good option if you rely heavily on voice communications or want your telephone's capabilities to include a speakerphone. The accompanying documentation will satisfy everyone from novice to expert, and the diagnostics disk is a welcome addition.

CIRCLE 600 ON READER SERVICE CARD

mute button for privacy during voice communications and a speaker on/off switch. The sliding volume control on the left side of the modem is a handy feature. Two RJ-11 phone jacks and the on/off switch are at



Just a second.

All of this becomes even more remarkable when you consider the price of the 9600EX. Just \$799. It's a price, in fact, that rivals high-end 2400 modems. It's also an example of Intel's commitment to affordable quality.

For more information, call 800-538-3373. Or for information faxed to you, call 800-525-3019 and

request Doc. #9986. But don't wait, because with all the 9600EX offers, it will go in a second.

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DOS

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peck peck peck
peck peck peck
peck peck peck
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Direct Access[®]

peck

Compared to a menu program like this, everything else is for the birds.

If you've got Direct Access, you don't need a whole flock of keystrokes to get into the programs on your hard disk.

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PC Magazine's Editor's Choice

CIRCLE 288 ON READER SERVICE CARD

Fifth Generation Systems, Inc., 10049 N. Reiger Road, Baton Rouge LA 70809 Sales Number (800) 873-4384 Technical Support (504) 291-9853

the rear, but the power switch isn't difficult to find when you need it.

VOICE/DATA SWITCHING

The easiest way to use the Evercom's voice/data ability is to communicate with a compatible modem made by Everex, EMAC, or Abaton. You can then switch between voice and data simply by picking up the handset. The modem on the other end of the connection automatically goes to voice mode, broadcasting your voice through its speaker.

This ability is particularly useful if you have only one phone line. But unless the other connected party has one of the three compatible modems, the two of you need to coordinate closely by typing on-screen warnings to pick up the handset at a certain time; otherwise you risk losing the connection. You'd benefit more by using the modem as a speakerphone add-on to a standard telephone.

THOROUGHLY DOCUMENTED

The Evercom is easy to set up, and it automatically defaults to the MNP 5 protocol when available. Its documentation is among the most thorough and well-designed we've seen. It accommodates the novice with detailed installation instructions but streamlines the information for the more accomplished user. Evercom also provides a two-year warranty and technical support at a toll number.

Currently, *Bitcom*, *Carbon Copy Plus*, *Crosstalk Mk.4*, *pcAnywhere*, and *WordPerfect Asynchronous Communication Gateway* list the Evercom as a setup menu option. With other software, choosing the Hayes selection works just as well.

In sum, the Evercom 24E Plus offers simple data-to-voice communications and the ability to upgrade your no-frills telephone to a full-fledged speakerphone. This is a solid modem that will please practically everyone who tries it.

GALAXY NETWORKS INC.

Pioneer

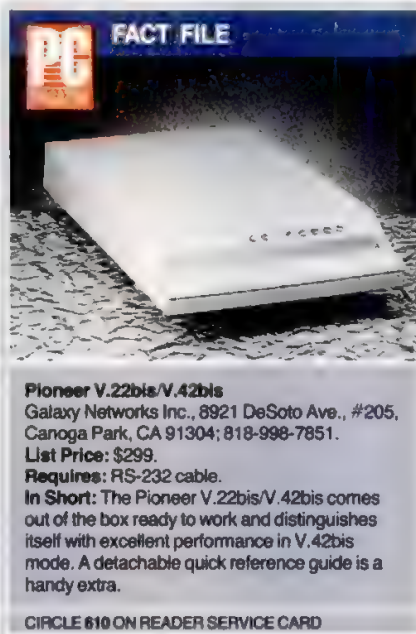
V.22bis/V.42bis

by Mike Byrd

Galaxy Networks provisions the Pioneer V.22bis/V.42bis well for the telecommunications wilderness with every possible option you need for modem connectiv-

ity up to 2,400 bps. The Pioneer features not only MNP 5 but also V.42bis data compression and V.42 error control, all for \$299. An equivalent internal model is also available for \$249. The shareware communications program *Telnet*, Version 3.11, comes bundled with the Pioneer.

This modem was easily one of the favorites of the PC Magazine LAN Labs. It popped out of the box ready to work with any other modem. During our hands-on tests, it connected reliably every time with



never a default. While the modem gave good results on our Compressible Data File throughput test in MNP 5 mode, it achieved excellent scores in V.42bis mode that tied for first place.

Rockwell manufactures the chip set. The modem comes in a lightweight gray molded plastic case with eight status indicators on the front panel. They divide into three different color groups: red for terminal ready and test modes, green for transmit and receive data, and yellow for high speed, auto-answer, off-hook, and carrier detect. The modem shows no indication of error control and data compression connections. It also lacks a manual volume control, but you can adjust the volume with AT commands.

The rear panel contains the female DB-25 connector, two phone jacks, the power connector, and an on/off switch. No labels appear on the rear panel, but each connector's function is self-evident, and the two RJ-11 jacks are interchangeable.

ZERO-HASSLE V.42BIS

Galaxy Networks assures Hayes Standard AT Command Set compliance with an MNP extended command set and extended S-register configuration for V.42 operations. The factory configuration comes ready for V.42bis operations out of the box. The modem works in synchronous and asynchronous modes and includes a line-quality monitor and retrain capability.

Although the Pioneer currently isn't listed on any communications program setup menus, it should work by default with programs that support Hayes modems. The only time you would need to alter the default configuration and fiddle with the command set would be for non-standard configurations.

If you need to make any adjustments, the Pioneer comes with a user manual and detachable quick reference guide. While it's a handy feature, the quick reference guide needs an S-register summary for completeness. The user manual is thorough and gives insight into error control and data compression operations.

The Pioneer V.22bis/V.42bis offers a two-year warranty, extendable to four years at extra cost. Unlimited technical support is available through a toll number. This is definitely a modem to consider if you're looking for excellent performance, ready-to-run operation, and hassle-free connections.

GVC TECHNOLOGIES INC.

GVC SM-24MV

by Mike Byrd

The GVC SM-24MV modem gets the job done in the most severe line-noise environments. For \$299 you get a modem with MNP 2 to 4 error control, MNP 5 data compression protocols, and the new V.42 error control protocol, but not the V.42bis data compression protocol. Despite that robust set of features, the SM-24MV demonstrated slow performance.

EXAR makes the SM-24MV's chip set. The rugged gray metal case measures 1.4 by 5.5 by 9.4 inches. The rear panel contains a well-marked power switch, a power plug, an RS-232C port, and telephone/wall connections.

The nine very visible LEDs on the white plastic front panel show the status for error test, high speed, auto-answer,

carrier detect, off-hook, receive data, send data, terminal ready, and modem ready. The error test indicator flashes when the modem detects and corrects an error. The high-speed LED indicates 2,400-bps operation.

MONITORING THE TRANSFER

A 2-inch speaker with a software-programmable volume control allows you to monitor the call progress and, with the right setup string, the data transfer. The external version of the modem lacks a manual volume control and bundled communications software: You can adjust the volume with AT commands.

The internal version, which sells for \$259, includes a program called *Combase*, which offers specific support for GVC products. The GVC modems also show up on the setup menus of *ColSession*, *Qmodem*, and *WordPerfect Office*. If you're using any other programs, keep in mind that GVC Technologies claims Hayes Standard AT Command Set compatibility, with the necessary extensions for MNP and V.42 operations.

The SM-24MV factory-default configuration supports connections with automatic V.42 error control and dynamic fallback to MNP level 5, or without data compression and error control. During our tests, the modem reported making an MNP 5 connection, but it ranked the slowest of all the modems on our Compressible Data File throughput test. The modem does al-

low you to disable MNP 5, a useful feature for connecting with a BBS and downloading already compressed files.

KNOWING THE OPTIONS

If you need help deciding how to use MNP and other features, you'll find the user manual complete. It explains each command's function, with extended discussions on the error control and data compression options and configurations. The documentation still needs an index. No quick-reference card is available, but the last appendix in the user manual includes a quick-reference guide.

GVC Technologies warrants the SM-24MV for five years. It also offers unlimited free technical support through a toll number. The SM-24MV is a good buy if you want a fairly complete range of error control and data compression schemes, but its slow performance can prove a real drawback in some installations.

HAYES MICROCOMPUTER PRODUCTS INC.

V-series Smartmodem 2400 V.42/X.25

by M. Keith Thompson

Hayes, a pioneer of PC modems, sells modems to fill a variety of needs. The V-series Smartmodem 2400 V.42/X.25 includes all the features of its big brother, the Hayes V-series Ultra Smartmodem 9600 (see "9,600-bps Modems: Breaking the Speed Barrier," *PC Magazine*, December 11, 1990), but limits the transmission rate to 2,400 bps. Since the company's products are often the standard against which other modems are measured, we included the V-series Smartmodem 2400 in our review despite its \$649 list price. (Note that Hayes still sells an older and less expensive 2,400-bps modem, the \$499 Smartmodem 2400, which does not include the MNP 5, V.42, V.42bis, and X.25 functionality found here.)

Hayes encases the V-series Smartmodem 2400 in the familiar sturdy case of brushed aluminum and black plastic. The eight LEDs, located on the flat front panel, are easy to see. On the back, Hayes supplies a power switch and clearly marks the

phone and data line jacks.

With MNP 5 data compression, the modem's scores on our Compressible Data File throughput test were well within the average range. With V.42bis, the smart



FACT FILE

V-series Smartmodem 2400 V.42/X.25
 Hayes Microcomputer Products Inc., 5835 Peachtree Corners East, Norcross, GA 30092; 404-441-1617.
List Price: \$649.
Requires: RS-232 cable, communications software.
In Short: The V-series Smartmodem 2400 V.42/X.25, while on the expensive side, works well and comes with the support of a large, established company. Its extra features make it a good choice for someone who needs the service of multiple X.25 connections.

CIRCLE #12 ON READER SERVICE CARD

modem's scores weren't just good—they were excellent.

WHAT DOES THE \$\$ BUY?

What do you really get for the extra cost of this modem? Other products coming in under \$300 provide synchronous communications, V.42bis, and MNP 5, so what makes the V-series Smartmodem 2400 so good?

Hayes has loaded this product with features aimed at the corporate communicator, including the ability to interface with many kinds of private branch exchange (PBX) telephone systems and a packet assembler/disassembler (PAD) for connections to packet-switched X.25 networks.

The PBX connections allow connection to a variety of leased lines and different signaling schemes. The PAD takes asynchronous data from the PC, assembles it into packets, and adds destination information. It then sends the packets to the X.25 network using the link access procedure balanced (LAPB) protocol. The popularity of X.25 in Europe and its increasing popularity in the U.S. make the X.25 capability important for managers of corporate information systems.

Another Hayes feature, Autostream, al-



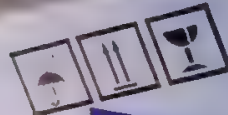
FACT FILE

GVC SM-24MV
 GVC Technologies Inc., 99 Demarest Rd., Sparta, NJ 07871; 800-289-4821, 201-579-3630.
List Price: \$299.
Requires: RS-232 cable, communications software.
In Short: The GVC SM-24MV modem offers connectivity to almost any modem, with or without error correction or data compression. It features data compression up to level 5, MNP error correction, and V.42 error correction. The modem's documentation is comprehensive, but the performance is slow.

CIRCLE #11 ON READER SERVICE CARD

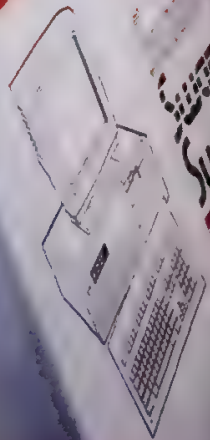
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—PC Magazine, 12/25/90

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386/25	VIDEO OPTIONS Include Monitor & Video Adapter			
	Drive Options	Mono	14" Flat Mono	1024 VGA
	w/50MB (17ms) IDE	\$1795	\$1845	\$1995
	w/100MB (17ms) IDE	\$2045	\$2095	\$2245
	w/200MB (16ms) IDE	\$2545	\$2595	\$2745

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—PC Sources, 11/90

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386SX/16	VIDEO OPTIONS Include Monitor & Video Adapter			
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—Daniel Morgan,
PC Magazine, 9/25/90



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Swan 250MB Tape Backup

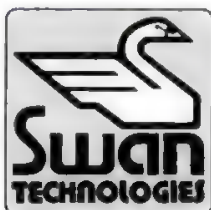
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Internal	\$319
External	\$419

Swan 120MB Tape Backup

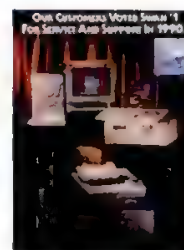
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lows a computer to have up to four virtual sessions with other computers, using a connection like an X.25 value-added network.

Hayes was one of the first companies to promote data compression and error correction on a large scale. The original V-series modems included Adaptive Data Compression (ADC) as the data compression technique and LAPB as the error-control protocol. Hayes includes ADC and LAPB for compatibility with existing modems.

OVERLOOKED USER CONTROLS

Hayes leaves out a couple of the useful features found even in less expensive modems, though. The more obvious of the two is the lack of a hardware speaker volume control. The modem also provides no voice/data toggle to make it easy for the user to switch to the telephone after transmitting data on the same line. At such a premium price, Hayes should include these two options.

Hayes provides a two-year limited warranty and free technical support at a toll number. It also offers a toll-free bulletin board for technical support.

The V-series Smartmodem 2400 V.42/X.25 provides high-quality performance and reliability from the most respected name in the business, but not at the lowest price. Hayes compatibility among the less-expensive V.22bis modems now in use is no longer a significant problem. But if you need the service of multiple X.25 connections, the Hayes modem is worth every penny.

INCOMM DATA SYSTEMS INC.

Midget 48E

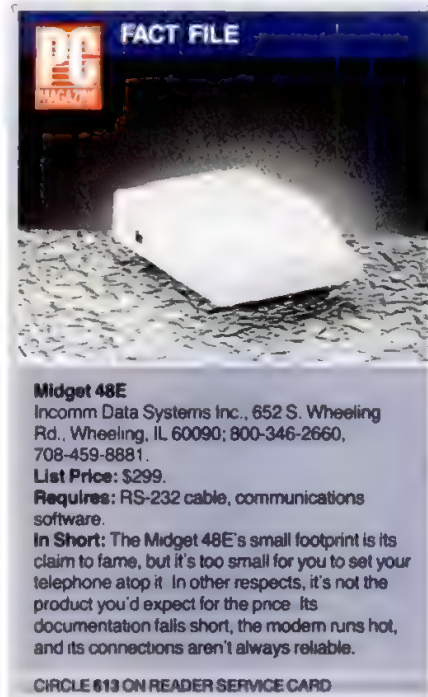
by Lisa Cady Newell

Incomm Data Systems' Midget 48E is the smallest MNP 5 modem currently on the market, measuring 1.5 by 4.5 by 6.5 inches. Since the lightweight molded plastic Midget's dimensions make it too small to slide underneath a standard desk telephone, you'll need enough room on your work surface for both.

Rockwell makes the \$299 Midget 48E's chip set. Incomm also offers an internal, machine-specific version, the Midget 48i, for \$289. Unlike the external version, the internal version ships with a

proprietary software package called *Bit Chat*. The external version we tested has MNP 5 capability, but we had to feed the modem a special setup string to awaken its MNP 5 software.

The modem includes seven LED lights on its sloping front panel to keep you apprised of transmission status, but they aren't particularly easy to see unless you look at them from directly above the mod-



dem. One of the lights flashes when an MNP 5 link is active.

On the rear panel you'll find two clearly marked RJ-11 jacks, an RS-232 port, and a power supply outlet. The on/off switch is conveniently located on the Midget 48E's right side, opposite four exposed DIP switches on the left side. These switches control the modem's ability to function as a Hayes-compatible modem, operate in command mode, or connect the carrier detect signal. While the modem lacks a manual volume control, AT commands can easily adjust the loudness.

The Midget 48E is listed as a menu option on *Carbon Copy* and *pcAnywhere*. With certain other communications packages, choosing the Microcom selection works fine, since the Midget 48E responds to Microcom's extended Hayes AT command set. The modem doesn't support synchronous protocols.

Incomm provides technical support for the Midget 48E through a toll number and

offers a bulletin board for testing. The company also supplies customers with a two-year warranty.

While the Midget 48E performed adequately in tests at PC Magazine LAN Labs, it initially aborted during several file transfers. The small modem case got quite warm after operating a few hours, though not hot to the touch. Finally, the sparse and rather generic documentation accompanying the Midget 48E assumes the user is well versed in modem operations; no handy aid or help files are available for quick reference. Frankly, there are better modem values on the market.

INTEL CORP.

Intel 2400EX MNP

by Mike Byrd

When you see the name Intel, you expect reliability. Intel fulfills this expectation with a great five-year warranty on its 2400EX MNP modem. The unit's \$349 list price exceeds our editorial price ceiling, but you can find the modem selling for less than \$250 in many retail ads. Additionally, Intel makes a modem chip set used by several competitors. At PC Magazine LAN Labs, we were interested to see how Intel put the chip set to work in its own product.

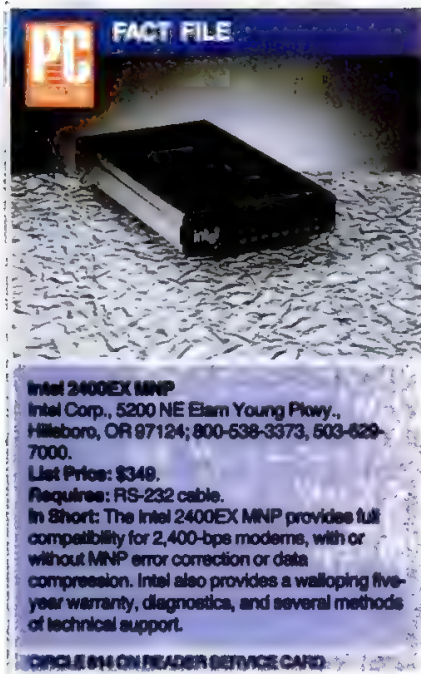
The Intel 2400EX MNP supports MNP classes 4 and 5, asynchronous operation, and a wide variety of international standards. Like other modems reviewed here, this unit combines Hayes AT compatibility with an enhanced instruction set for MNP operations. In addition, the 2400EX MNP instruction set also allows you to disable MNP 5 for already compressed file transfers.

The attractive burnished aluminum case, with black plastic front and rear panels, measures only 1.3 by 5.5 by 9.6 inches. The front panel contains eight LED status indicators, including high speed, auto-answer, carrier detect, off-hook, receive data, send status, terminal ready, and modem ready.

The status lights show no indication of when error correction or data compression are operating. The unit's well-labeled rear panel provides a toggle power switch and separate RJ-11 jacks for wall and telephone connections. The modem lacks a hardware volume control, but you can al-

COMMUNICATIONS

2,400-bps Modems



guide, a shortcut installation guide, and a command guide. Each booklet describes in laymen's terms what you need to know.

The factory-default configuration initializes the modem for Hayes-compatible connections. For MNP operations, you must reconfigure the modem. The documentation clearly leads you through this procedure. A helpful section on troubleshooting includes symptoms and solutions for a variety of common problems.

One of the 2400EX MNP's unusual and noteworthy features is a modem diagnostics program. The program checks your computer's serial interface and performs a series of digital and analog tests on the modem. All program instructions and results are clear and self-explanatory. The package also includes MagicSoft's MTEZ communications software.

INTEL VS. THE COMPETITION

The Intel 2400EX MNP didn't outpace all its competitors in performance; in fact, it abnormally terminated a couple of our file-transfer tests but completed each test on a second attempt.

Aside from the five-year warranty, Intel sets the standard for technical support with toll-free fax and voice numbers. Additionally, if you have a Touch-tone phone and a fax machine, you can order a fax copy of any document in Intel's tech support library. And you can use your modem to call Intel's BBS or reach the company through CompuServe or MCI Mail. With all these services and the backing of the Intel name itself, you can be sure that the 2400EX MNP will give you a reliable connection.

LONGSHINE TECHNOLOGY INC.

Longshine LCS-8824 MNP 5

by Kimberly Maxwell

Packaged in a shiny metallic case that gives it a space-age look, the \$259 Longshine LCS-8824 MNP 5 measures 1.1 by 5.3 by 9.5 inches. The Longshine product features an EXAR chip set and eight easy-

ways adjust the volume with software commands.

DOCUMENTED AND DIAGNOSTIC HELP

Intel's documentation is outstanding. The modem comes with a detailed installation





Longshine LCS-8824 MNP 5

Longshine Technology Inc., 2013 N. Capitol Ave., San Jose, CA 95132; 408-942-1746.

List Price: \$259.

Requires: RS-232 cable, communications software.

In Short: Decent performance, good design, a low price, and no extra frills make the Longshine LCS-8824 MNP 5 a great bargain, but the lack of an FCC Class B rating detracts from its appeal to a potentially large market for a low-cost modem—home users.

CIRCLE 618 ON READER SERVICE CARD

to-see indicator lights on the front panel, including an AA light for auto-answer mode and a high-speed light to show when the modem is transmitting data at 2,400 bps.

COMMUNICATIONS

2,400-bps Modems

The well-marked back panel includes an on/off switch and two RJ-11 jacks. It comes with a power adapter and a telephone cable.

You'll have to purchase a communications software package separately. The LCS-8824 unit supports the Hayes Standard AT Command Set, so you can use almost any communications program with the modem.

TWIST UP THE VOLUME

The LCS-8824 offers an interesting twist for controlling the volume. You open up the modem's case and adjust it with an internal knob. It's not as flexible as modems that provide this capability on the outside, but any hardware control provides finer adjustment than software-only volume controls.

The LCS-8824 supports MNP levels 2 to 5. Its configuration is preset to MNP 5, so you don't have to touch any jumpers in the modem to get data compression capability right out of the box. You can quickly disable MNP 5 using the AT&E0 command. Be aware that the modem does not

support synchronous operation.

At PC Magazine LAN Labs, the modem performed the Compressible Data File throughput test adequately, with no interruptions, and compared well with its competitors. The LCS-8824 also connected reliably with Hayes and U.S. Robotics modems.

The manual is a nice accompaniment to the modem. It contains helpful graphics representations of the modem and its operations. A smaller six-page manual offers a complete set of quick-reference AT commands.

If you have any problems, Longshine Technology provides free technical support for the LCS-8824. A one-year warranty on parts and labor covers the modems.

If you're interested in purchasing an internal modem, Longshine markets a version for a low \$109. The external version of the LCS-8824, offering dependable data communications and decent performance, won't disappoint the corporate user. One real pity here, though, is that the modem gets only a Class A rating from the FCC, while many of its peers have Class B approval.

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PC Magazine

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\$35. And through March 31, 1991 anyone can trade in other file managers and receive XTreeGold 2.0 for \$50.00. Call 1-800-282-5000.



PERFORMANCE TESTS: 2,400-BPS MODEMS

Compatibility and conformity generally rule the V.22bis modems operating at 2,400 bps. Those modems supporting the V.42bis data compression protocol stand out among the crowd, clearly moving compressible files faster than those using MNP 5 data compression.

The Compressible Data File test reports the throughput we measure when two like modems transfer a mixed data file of ASCII characters that is capable of being compressed.

We tested these modems in many ways and found few performance differences. Our test activities included checking each modem for compatibility against both a Hayes V-series Ultra Smartmodem 9600 and a U.S. Robotics Courier HST Dual Standard modem, running each modem in its MNP 5 mode and V.42bis mode (if available) through an automated bit error rate test, and running two file-transfer tests to gauge throughput between PCs over a simulated average-quality U.S. telephone line. The compressed and noncompressible files used in the file transfer test are part of a standard suite provided by the CCITT. Both files are over 50K in size.

We used two Dell System 200 computers with 80286 processors operating at 10 MHz, each driving an identical modem, to send and receive files. All of the modems we tested support port speeds of 4.8 or 9.6 kilobits per second. We ran the computers at a port speed of 9.6 kilobits per second to allow maximum throughput.

We ran the Telix communications software and transferred files using the YModem-G protocol. This protocol has no data compression and no error control; that makes it the appropriate protocol to run when the modems contain both

features. YModem-G will abort the transfer when any glitch occurs between the modem and the computer.

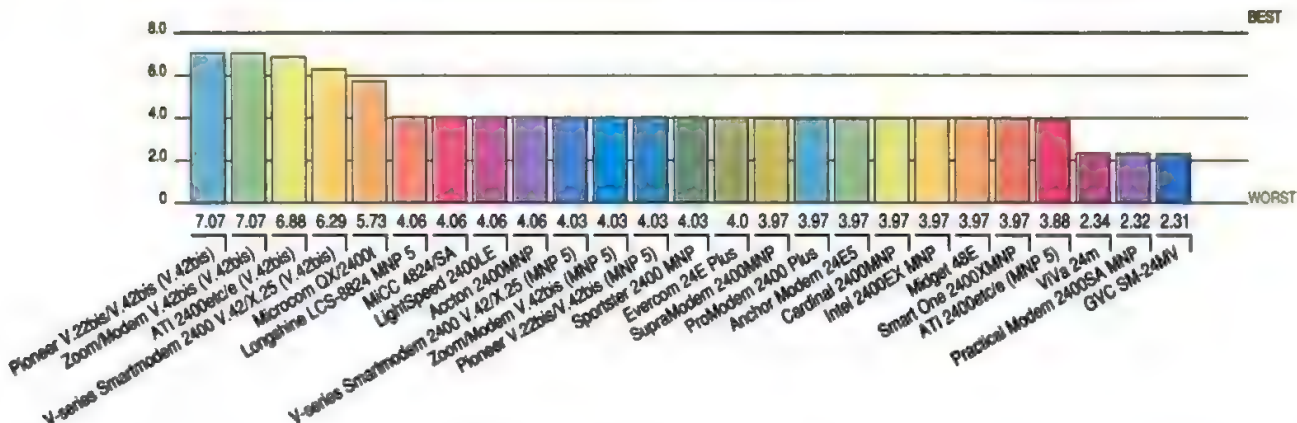
The modems connected through the TAS 122 Telephone Network Simulator, configured to represent the conditions of a U.S. standard telephone line.

We performed the bit error rate tests using the TAS 122 Telephone Network Simulator, marketed by Telecom Analysis Systems, and the TAS Gemini 1022 Dual Terminal Emulator. The TAS *Taskit* software prepares printed reports showing the error rate of each product.

The TAS 122 Telephone Network Simulator helped us simulate a complete telephone network, with capabilities for two- and four-wire connections, dual-tone multifrequency dialing, and internal impairment generators driven by a stored suite of profiles. These profiles meet the standards established for testing by the Electronic Industries Association (EIA). The TAS Gemini 1022 Dual Terminal Emulator automatically manages two modems and measures various technical parameters during their communications session.

Compressible Data File

Throughput (kilobits per second)



The File Throughput test results show the superiority of V.42bis compression over MNP 5 compression. The Pioneer V.22bis/V.42bis, Zoom/Modem V.42bis, ATI 2400etc/e, and Hayes V-series Smartmodem 2400 V.42/X.25, all operating in V.42bis mode, chalked up the highest scores on the Compressible Data File test. But as we demonstrated in our review of V.32 high-speed modems with V.42bis ("9,600-bps Modems: Breaking the Speed Barrier," December 11, 1990), you can usually achieve comparable throughput or better by compressing a file with any available compression utility before transmission.

The fast performance of the Microcom OX/2400t running under MNP 5 on the Compressible Data File test comes primarily from its 4,000-bps modulation rate. Yet the same modem could not complete our file transfer test for noncompressible files using the 4,000-bps modulation rate, so we had to drop back to 2,400 bps. (In addition to MNP 5, the Microcom modem also uses MNP 7 data compression. We did not test the modem using this scheme because, unlike V.42bis, it is not widely supported.)

Because we reviewed 21 modems and 4 of

them had both MNP 5 and V.42bis capabilities, we are reporting 25 scores for the Compressible Data File throughput test.

NONCOMPRESSIBLE DATA THROUGHPUT AND COMPATIBILITY TESTING

We also ran the Noncompressible Random Data File test, which measures the throughput when two like modems transfer a noncompressible file containing a completely random sequence of data. We are not reporting the specific results of the latter test, because the throughput rates for all products turned out to be within an extremely narrow range of 2.22 to 2.26 kilobits per second.

The compatibility tests showed all modems successfully connecting with the two reference products and doing so within 1 second of each other. Because we found no significant differences, we are not reporting the specific results of these tests.

BIT ERROR RATE TESTING

We also ran each modem through a series of seven Bit Error Rate tests. Six tests determine how well the modem works under the six impaired line conditions meeting the Test Channel Impairment Combination standards established

by the EIA and described in EIA/TIA standard 496-A. One test determines how well it works using the conditions of a typical U.S. standard line. In each case, we adjusted the loop loss to U.S. standards to simulate the gain on a typical phone circuit.

Because the MNP 5 and V.42bis protocols perform error control, the Bit Error Rate results showed either zero errors or failed connections. We are not reporting the specific results of these tests because most of the units never failed to connect and generated no errors during the transfer. The Accton 2400MNP and the Pioneer V.22bis/V.42bis did have some problems. Under one degraded line condition, the Accton connected but aborted the data exchange. The Pioneer aborted the data exchange under two degraded line conditions in V.42bis mode and one degraded line condition in MNP 5 mode. We were not able to determine the exact cause of each abort, but the results were consistent, and the other modems did not experience problems with these tests.

Our results do not reveal any pattern based on the type of modem chip set or the line degradation condition when the modems failed.

MICROCOM INC.

Microcom QX/2400t

by M. Keith Thompson

MNP stands for Microcom Networking Protocol, and Microcom modems live up to the standards the company creates. Its \$699 QX/2400t (included here because of Microcom's role in developing MNP) is no exception.

It is made of black high-impact plastic and measures 2 by 6.5 by 11 inches. Inside, it uses a Sharp Electronics chip set. Outside, the front panel has two buttons, one for answer or originate mode, the other to switch between data and voice mode. Seven LEDs on the front panel display the status of the modem and the connection.

The back of the modem includes descriptions of each item. Microcom clearly labels the phone and line RJ-11 jacks and includes an eight-position DIP switch. You also get a reset button on the back, but no power switch.

Adjusting the volume control is a little tricky, requiring a small screwdriver and a steady hand. We weren't able to adjust the volume with software commands. Microcom doesn't bundle a communications program, but many include Microcom as a selection on their setup menus.

FASTER THROUGHPUT

The software in the QX/2400t operates as a superset of existing modem standards. Be-

sides the standard 2,400-bps modulation rate, the QX/2400t adds two new rates, 3,200 and 4,000 bps. These faster rates should have made the Microcom QX/2400t the fastest modem we tested, since it can actually connect at 4,000 bps. (Other MNP 5 modems have only a potential throughput of 4,800 or 9,600 bps between the modem and the PC.) Indeed, its performance was above average on our Compressible Data File Throughput Test—in fact, it was the fastest of all modems using MNP 5. Yet it was bested by modems using V.42bis, which it does not offer.

Overall, the Microcom QX/2400t modem provides excellent functionality, but you expect that for the \$699 price.

The modem automatically enables MNP 5. Instead of V.42bis, Microcom's modem provides the enhanced MNP 7 data compression and MNP 10, which works to optimize performance over poor or varying-quality telephone lines.

REMOTE ACCESS BUILT IN

Probably the most useful extra feature for an experienced user is remote access. Particularly handy for troubleshooting, remote access lets the user call the modem from a remote site and view its configuration or change it. For security reasons, Microcom password-protects entry to the remote access mode.

Microcom provides a one-year limited warranty and free technical support at a toll number. The documentation it supplies is above average.

Overall, the Microcom QX/2400t provides excellent functionality, but you expect that for the price. With features like password protection, remote reconfiguration, and 4,000-bps line speed, the QX/2400t adds the extra functionality some users may need, but at a price.

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**Microcom QX/2400t**

Microcom Inc., 500 River Ridge Dr., Norwood, MA 02062; 800-822-8224, 617-551-1000.

List Price: \$699.

Requires: RS-232 cable, communications software.

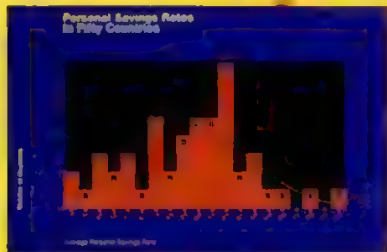
In Short: The QX/2400t is a high-quality product that offers extra features like a 4,000-bps line speed and remote reconfiguration. Many users will never need these features; those who do will have to pay Microcom a premium for them.

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**MICRO INTEGRATED
COMMUNICATIONS CORP.**

MiCC 4824/SA

by M. Keith Thompson

In addition to the MNP 1 to 5 protocol set offered by many competitors of the Micro Integrated Communications Corp. (MiCC), the MiCC 4824/SA modem package offers V.42 error control. Priced at \$295, the MiCC 4824/SA provides problem-free if not quite top-speed performance.

EXAR makes the MiCC 4824/SA's chip set. MiCC packaged the well-made 4824/SA in a beige aluminum case measuring 1.5 by 6.5 by 7.5 inches. The 4824/SA's front panel displays the familiar Hayes-like LED indicators, including high speed, auto-answer, carrier detect, off-hook, receive data, send data, terminal ready, and modem ready. The front panel also holds a switch that allows you to control the automatic-answer mode of operation. The 4824/SA lacks an LED to inform you of an error-correcting link, however, and it doesn't include a manual volume

COMMUNICATIONS

2,400-bps Modems



MiCC 4824/SA

Micro Integrated Communications Corp., 3255-3 Scott Blvd., #102, Santa Clara, CA 95054; 408-980-9565.

List Price: \$295.

Requires: RS-232 cable, communications software.

In Short: The 4824/SA includes V.42bis and provides decent performance, offset by poor documentation and this version's lack of a hardware or software volume control. It's an acceptable but not especially exciting choice.

CIRCLE 617 ON READER SERVICE CARD

control. The modem we tested also provided no software method for adjusting the volume, but MiCC says that it implements software control in the firmware it is now shipping.

The clearly labeled rear panel connections include two RJ-11 jacks. An eight-position DIP switch, located on the bottom of the modem, manually controls various states, including the data-terminal-ready and clear-to-send functions.

MiCC has patterned its extended AT command set after that used by the Microcom modems, with commands to turn the MNP result codes on and off, force an MNP connection, and automatically determine the connection protocol. In its default setting, the modem automatically enables MNP level 5 when the connection is possible.

The unit does not include any bundled communications software. At press time, there were no communications programs in public release that included the 4824/SA on their setup menus. Micro Integrated Communications says it is in contact with several communications software vendors, and the modem may show up soon on some program menus.

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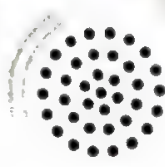


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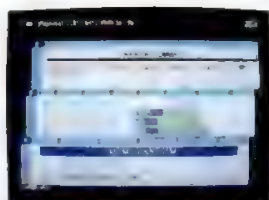
MATERIAL COLLECTION



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Glass	16,248,804
Aluminum	12,680,356

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WeCycle Waste Corporation

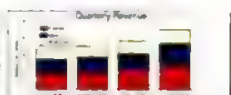
Last year was a good year for the company. WeCycle was profitable and came very close to achieving our goals in a very uncertain economic and recycling climate.

Revenue by Product

Material collections increased over the year. Plastics continue to bring in the most revenue and profit for the company. Prices for aluminum are still very soft and while we're working to correct more glass markets for the new materials, are still in their infancy.

Revenue	Q1	Q2	Q3	Q4	1990
Plastics	1,600,763	1,982,024	2,373,307	2,838,583	9,094,677
Glass	1,710,304	1,892,135	1,889,430	2,800,984	8,302,753
Aluminum	1,148,864	1,182,022	1,489,421	1,161,783	5,420,090
Total	\$4,459,931	\$5,056,181	\$5,752,158	\$6,801,350	\$22,873,519

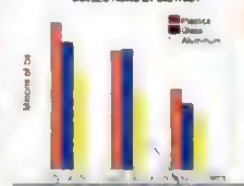
The graph at the right details our revenue by waste material for the four quarters of 1989. The revenue increases show that our programs are building their recycling programs beyond just collecting plastics. Having more aluminum and glass have increased as their programs have gained volume. But we're still seeing price pressure as the supply of recyclable materials continues to exceed the demand. We need to look for ways to expand our markets and increase the use of recycled materials.



Collections by District

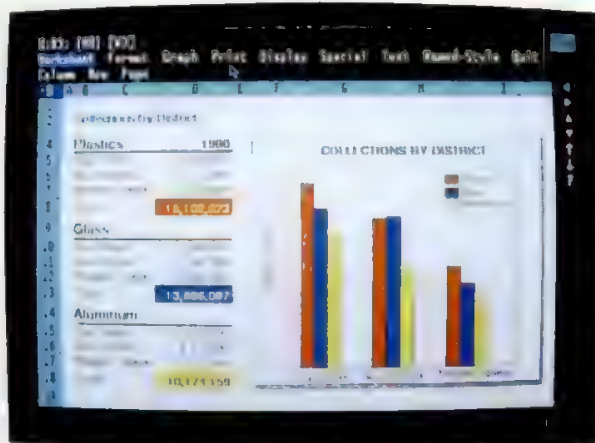
Plastics	1989
City Center	8,603,800
South Shore	5,115,450
Western	3,525,544
Total	17,244,794
Glass	1989
City Center	2,800,984
South Shore	1,889,430
Western	1,710,304
Total	6,400,718
Aluminum	1989
City Center	1,161,783
South Shore	1,182,022
Western	1,148,864
Total	3,492,669

COLLECTIONS BY DISTRICT



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Lotus 1-2-3 3.1

COMMUNICATIONS

2,400-bps Modems

MODEM INCOGNITO

The manual that accompanies the MiCC 4824/SA could use several improvements. For example, MiCC omitted its name, address, and phone number from the documentation. The manual also lacks a diagram describing the cable pin-outs. We would like to see the documentation better organized: While it includes a complete listing of the AT commands and S-register values, the information about why you would want to use these values turns up in a separate section. These may seem like trivial issues, but competition among modems is stiff.

MiCC offers a two-year parts-and-labor warranty and free technical support. But the telephone call for support is not free. The MiCC 4824/SA is a middle-of-the-road product, providing acceptable mid-range scores on our Compressible Data File throughput test. At present, its one standout feature is its V.42 error correction; MiCC has plans to add another standout feature in the near future—V.42bis. Until then, the MiCC isn't very different from many other modems on the market, and represents a passable if not particularly enticing buy.

PRACTICAL PERIPHERALS INC.

Practical Modem 2400SA MNP

by Mike Byrd

The Practical Modem 2400SA MNP combines reliability with a superior five-year warranty for \$299. Practical Peripherals is well known and well connected (Hayes is its parent company), but the modem didn't break any speed records during our testing.

The Practical Modem supports MNP 1 to 5 and a variety of signaling standards. It gave us reliable MNP 5 connections but the throughput during file transfers wasn't on a par with its competitors. In fact, it bested only one other product on our Compressible Data File throughput test. On the plus side, the modem didn't disconnect or abort the file transfer.

MNP VISUAL INDICATORS

The sleek white molded plastic case, measuring 1.3 by 5.5 by 10.5 inches, has a

front panel with seven LED status indicators: modem ready, transmit data, receive data, carrier detect, off-hook, auto-answer, and high speed. The high-speed light

The MiCC 4824/SA

includes a fairly
standard two-year
parts-and-labor

warranty. The
modem's one standout
feature is its V.42 error
correction.

will glow orange at port speeds greater than 2,400 bps (MNP 5 mode), green at 2,400 bps, and red at 1,200 bps; it will not glow at 300 bps. The receive data indicator

From The People Who Brought You The Impossible On The Previous Page.

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COMMUNICATIONS

2,400-bps Modems

glows red when data flows in on the line. It flashes green when the MNP error control circuits detect an error and correct it.

The rear panel contains no markings, but the two RJ-11 jacks there are interchangeable; you can connect the data line or telephone to either one. The power switch on the back is a small toggle switch that may be hard to find. An on-board speaker allows call-progress monitoring, but there is no manual volume control. You won't find any DIP switches on the unit either; you make all configuration changes through the modem command instruction set.

DETAILED MANUAL

The modem's operating manual displays a noteworthy attention to detail. The manual succinctly covers all operations for installing, configuring, and operating the modem. Particularly commendable is the troubleshooting section.

The Practical Modem claims full Hayes Smartmodem 2400 compatibility. It contains the same Rockwell 2424DP chip set

used by Hayes, as well as an Intel 8031 microprocessor for command and modem control.

The Practical Modem uses the standard AT command set, with an extension to control the MNP functions. The factory-default configuration specifies a direct

The Practical Modem

2400SA MNP

combines reliability
with a superior five-
year warranty.

connection with error control off and data compression on. You must use the extended command set to initialize the modem for MNP error control operations, and there's a command to disable MNP 5 data compression. The modem does not sup-

FACT FILE



Practical Modem 2400SA MNP

Practical Penpherals Inc., 31245 La Baya Dr., Westlake Village, CA 91362; 800-442-4774, 818-706-0333.

List Price: \$299.

Requires: RS-232 cable, communications software.

In Short: With Hayes compatibility, MNP 1 to 5 error correction, and data compression, the Practical Modem 2400SA MNP offers a reliable if not speedy solution to your modem needs.

CIRCLE 618 ON READER SERVICE CARD

COMMUNICATIONS

2,400-bps Modems

The Practical Modem 2400SA MNP contains the same Rockwell 2424DP chip set used by Hayes, as well as an Intel 8031 microprocessor.

tion for product quality and support. The Practical Modem's five-year warranty and free technical support through a toll number are welcome, as is the support via Practical Peripherals' BBS and its own CompuServe forum. If you're looking for a practical and reliable solution, and speed is not of the utmost concern, this one may be worth investigating.

PROMETHEUS PRODUCTS INC. **ProModem 2400 Plus** by Lisa Cady Newell

A well-rounded modem with lots of good but not outstanding features, Prometheus Products' ProModem 2400 Plus is a mid-range offering. It's a pleasant-looking and useful product, but the \$299 model we reviewed won't wow you with any fancy advancements.

The package comes with a power adapter, telephone cord, user manual, and

port synchronous operation.

The external version we reviewed doesn't come bundled with any communications software, but an internal version, available for \$249, includes *ProComm*, Version 2.4.3. Practical Peripherals also shows up on the setup menus of many communications programs, including *Carbon Copy*, *Crosstalk*, *pcAnywhere*, *Qmodem*, and *RBBS*.

Practical Peripherals has a good reputa-

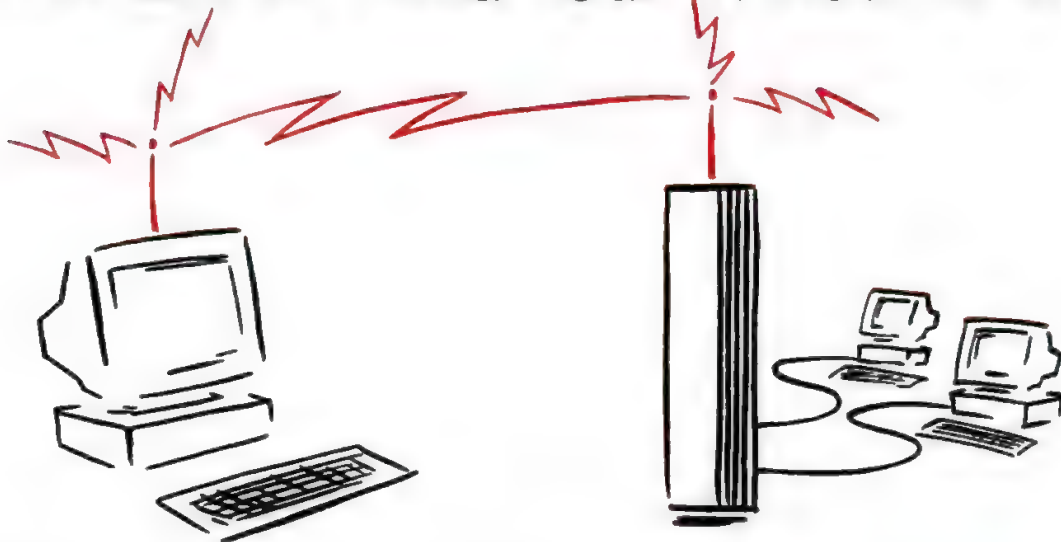
PC
FACT FILE



ProModem 2400 Plus
Prometheus Products Inc., 7225 SW Bonita Rd., Tigard, OR 97223; 800-477-3473, 503-624-0571.
List Price: \$299.
Requires: RS-232 cable, communications software.
In Short: The ProModem 2400 Plus offers the basic features but lacks the extras provided by some similarly priced modems. It does have the advantage of coming from a company with a history of modem manufacture.

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COMMUNICATIONS

2,400-bps Modems

two-year warranty. The internal version, the ProModem 2400 B Plus, is available for a list price of \$249.

Prometheus has long specialized in modem technology. The company places its current emphasis on modems with fax capability, although neither the external nor internal version of this modem supports fax transmission. The ProModem 2400 Plus does support both synchronous and asynchronous communication.

STANDARD FEATURES

At 2.3 by 6.5 by 11.5 inches, the ProModem 2400 Plus is rather large for a desktop modem, but it can slide beneath your telephone to save space. The body is made of high-impact molded plastic with a red plexiglass cover over the front LED display panel. The sloping front panel signals transmission status with eight LED lights, while the rear panel includes an on/off switch, a volume control, and two clearly marked RJ-11 jacks. The slim volume control is located between the on/off switch and the RS-232 cable, making it difficult even for slender fingers to reach. You can also adjust the volume by using AT commands.

Intel makes the ProModem's chip set. The modem defaults automatically to MNP 5 data compression. It can work with either single or multiple phone lines, al-

though you will need to remove its case and switch the jumpers to enable the multiple-phone-line feature.

It's very simple to set up the ProModem 2400 Plus because it comes with easy-to-understand documentation as well as free access to the Prometheus BBS to help you check your setup. The modem is also compatible with all major diagnostics software to facilitate troubleshooting.

HyperAccess/5's modem menu includes the ProModem 2400 Plus as a menu option, making setup even easier with this program. In case your communications program doesn't include a ProModem 2400 Plus option on the menu, the modem conforms to the selection of Hayes on the installation menu as a default.

Although it offers many of the same useful features found on other modems and demonstrates average performance on our Compressible Data File throughput test, the ProModem doesn't dazzle with standout features. It would be nice if the lack of fancy extras meant a corresponding drop in price, but if you buy the ProModem 2400 Plus, at least you'll know you're getting a product from a company with a name in modem technology.

The sloping front panel
of the ProModem 2400
Plus signals
transmission status
with eight LED lights,
while the rear panel
includes a volume
control and two clearly
marked RJ-11 jacks.

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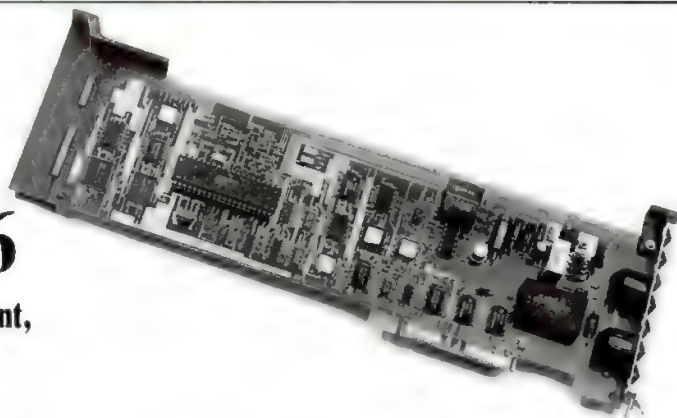
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SUPRA CORP.

SupraModem 2400MNP

by Kimberly Maxwell

If you need a low-cost modem that won't use up a lot of room on your desk, take a good look at the SupraModem 2400MNP. It's one classy little chassis. The \$199.95 package we tested for this roundup offers solid performance and the ability to upgrade to V.42bis capabilities.

The SupraModem measures 1 by 4.6 by 6.5 inches. The case is a little too small to hold a standard telephone, but you can tuck it away next to your computer or on top of it. The adequately marked back panel includes two RJ-11 jacks. There is no manual volume control, but you can adjust the modem's speaker volume using an AT command in the communications software.

If you're looking for an internal modem, you can buy a version of the SupraModem for \$169.95, including SoftKlone's *Mirror II* program. SoftKlone's

The SupraModem is
too small to hold a
standard telephone,
but you can tuck it
away next to or on top
of your PC.

Mirror III includes the SupraModem on its modem selection menu, but you can use almost any communications program with either the external or internal version, as long as it supports Hayes V-series modems.

You can store up to four telephone numbers in the modem's nonvolatile memory. And you can store up to two frequently used modem configurations.

PROBLEM SPOTTING

By default, the SupraModem 2400MNP external modem is set to smart mode, allowing you to send it commonly used AT commands. You can change the setting to

COMMUNICATIONS

2,400-bps Modems

dumb mode if you want it only to answer calls.

The device's front panel consists of eight LED indicators that can help you spot problems like a short in the RS-232 cable or a serial port glitch. The LEDs are clearly visible in any mounting position.

The manual's troubleshooting section and the modem's two diagnostic tests as-



SupraModem 2400MNP

Supra Corp., 1133 Commercial Way, Albany, OR 97321; 800-727-8772, 503-967-9075.

List Price: \$199.95.

Requires: RS-232 cable, communications software.

In Short: A good-looking small modem at a reasonable price, the SupraModem 2400MNP offers midrange performance and the ability to upgrade to V.42bis.

CIRCLE 620 ON READER SERVICE CARD

sist in identifying the specifics. The manual gives good graphical illustrations of installation for both external and internal modem types, and it comes with a quick-reference card.

V.42BIS UPGRADE

The SupraModem features an Intel chip set and supports MNP 2 to 5. For an additional \$40, you can upgrade the modem to include V.42bis for better data compression; this option is available from the company now but wasn't ready in time for our testing.

Supra Corp. offers a full five-year warranty on its product. If you experience any problems, you can call for free technical support at a toll number. A small modem, the SupraModem 2400MNP offers dependable results—with a quite acceptable midrange score on our Compressible Data File throughput test—at an affordable rate.

U.S. ROBOTICS INC.

Sportster 2400 MNP

by Kimberly Maxwell

U.S. Robotics' Sportster 2400 MNP modem resembles a small intercom box. Despite its interesting look and dependable test results, the \$299 modem offers little more than the standard features found in most V.22bis modems, and it works only in asynchronous mode.

The Sportster carries MNP 2 to 5 and uses an SSI chip set. It offers one of the smallest footprints among the modems we tested. The 1.5- by 3.8- by 6.5-inch case includes an on/off button that is conveniently located on the front panel. Two indicator lights signal the modem ready and carrier detect status but are difficult to see when lit.

The adequately marked back panel includes two RJ-11 ports along with DIP switches. You must carefully set the DIP switches so they can properly determine the carrier detect and data terminal ready signals.

NOT EXACTLY HAYES

U.S. Robotics doesn't bundle any communications software with the external model, but the \$239 internal unit comes with DCA's *Crosstalk Communicator*. Several of DCA's *Crosstalk* packages specifically name the Sportster in their modem setup menus, and you can choose the U.S. Robotics 2400E Courier selection from the menus of many other communications programs currently on the market. You need U.S. Robotics-compatible software because the system's MNP 5 setup string is different from the one that is used in Hayes modems.

The documentation describes the full set of commands and options and provides nice graphical representations of transmission schemes and flow control. The manual also includes a handy quick-reference card for checking the defaults. A mini-manual on the underside of the device lists switch settings and commonly used commands.

After you check the DIP switch settings on the modem and connect the cables, you're ready to use the Sportster in its full capacity as an asynchronous communications device. In the default mode, the RS-232 port speeds and line connection speeds are the same, but as with other modems, you can set the port speed above the line

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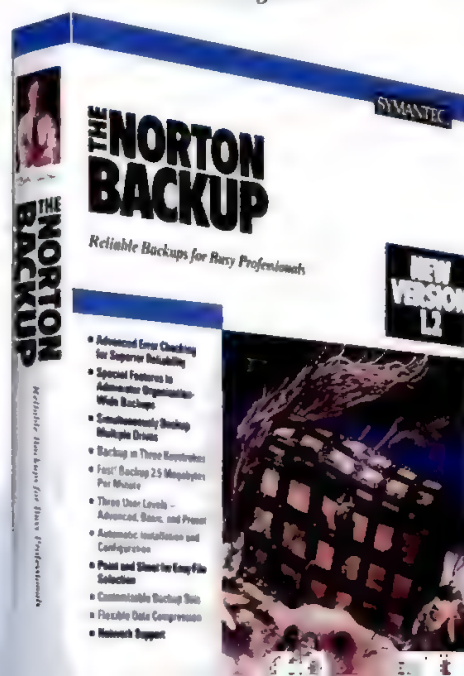
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—*InfoWorld*

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CIRCLE 504 ON READER SERVICE CARD

Turning An External Modem Inside Out

by Frank J. Derfler, Jr.

The layout of the Zoom/Modem V.42bis is typical of these external modems. The four logical functional elements of the product include the section dealing with the telephone line (the dial-tone detection and line filtering), the user interface (the LEDs and speaker), the RS-232 interface, and the internal processor with its associated support chips and programs in ROM.

The power supply section, in the lower right corner, is protected by an internal fuse that is easy to replace. The cluster of capacitors in the lower right corner of the modem smooth and regulate the voltage coming in from the wall transformer.

Resistors next to the RS-232 connec-

tor provide proper electrical termination for the cable coming from the PC's serial port. Nearby chips buffer the data and link the serial RS-232 signals to the parallel processor in the Zoom/Modem's Rockwell chip set.

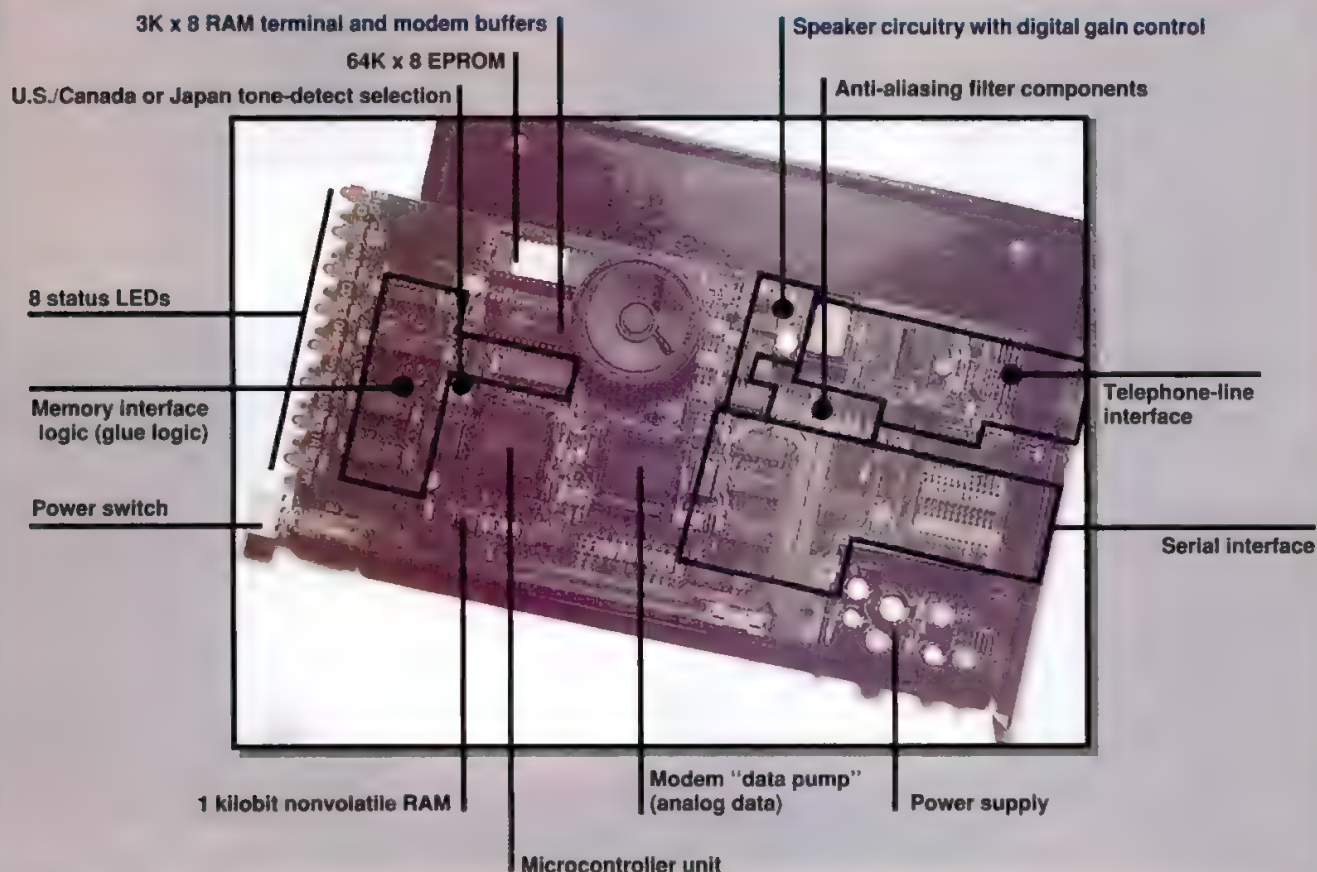
The telephone interface components, including the line transformer, cluster around the telephone jacks. They provide filtering and voltage protection that meet the standards of Part 16 of the FCC rules.

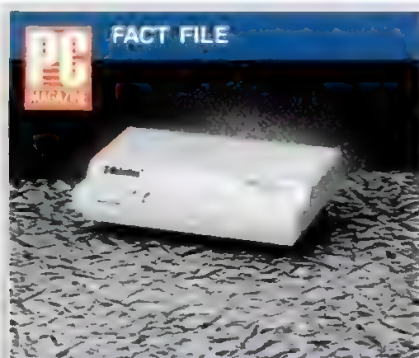
The speaker and its audio components provide *call progress monitoring*, letting you hear what is happening during the call. In the vicinity of the speaker are the programmable read-only memory (PROM) holding instructions for

the dual Rockwell modem chip set. The chip set processes instructions in the PROM and follows its own application-specific logic to follow the AT command set, MNP 5 protocols, and V.42bis protocols. The 1 kilobit of nonvolatile RAM in the lower left area can hold phone numbers and setup parameters.

The tone filter selects from the different dial tones used in various countries so that the modem can detect the presence of a dial tone. The status LEDs on the front panel of the Zoom/Modem provide information on the connection status of the modem and the data moving across it. The front-panel power switch makes it easy to control the power to the modem.

Zoom/Modem V.42bis



**Sportster 2400 MNP**

U.S. Robotics Inc., 8100 N. McCormick Blvd., Skokie, IL 60076; 800-342-5877, 800-982-5151 (tech support).

List Price: \$299.

Requires: RS-232 cable, communications software.

In Short: The Sportster 2400 MNP looks different from the other modems in its category on the market, but it performs reliably in the midrange, along with many of its competitors. It comes with good documentation.

CIRCLE 621 ON READER SERVICE CARD

rate to take advantage of MNP 5 data compression. And you can store a single phone number in the modem using a simple AT command.

SQUELCHING THE SPORTSTER'S SOUND

During our testing process, we found the Sportster very dependable and able to perform at midrange speed on our Compressible Data File throughput test, but when we first plugged in the device, the sound level was at the maximum. We used an AT command to change the loudness; there is no manual volume adjustment.

U.S. Robotics offers a full warranty package, including extensions beyond the original two-year factory warranty. The company also provides free technical support on a toll-free line, along with BBS support.

You won't find the Sportster 2400 MNP blossoming with extra features, but you will find it dependable. Reliability and convenient documentation make this product a good selection.

ZOOM TELEPHONICS INC.**Zoom/Modem V.42bis**

by Kimberly Maxwell

Zoom Telephonics offers a 2,400-bps modem with advanced V.42 and V.42bis error control and data compression features

to help alleviate pesky communication problems. Like most of our other units, it also supports MNP 2 to 5. A well-designed modem with features that should appeal to corporate buyers, the Zoom/Modem V.42bis carries a \$299 price tag.

The professional-looking unit completed our tests at top speeds without a single balk. The modem can work at V.42bis right out of the box, without making you invoke complex setup strings.

BIG, BRAVY, AND CORPORATE

The Zoom/Modem is built to last. It comes in a solid metal case that measures 1.8 by 7.8 by 11.4 inches. The Zoom/Modem is specifically designed to hold the kind of large multiline desk phone with auto-dialer that's commonly found in businesses. It offers a pleasing front-panel display with a conveniently located on/off switch and easy-to-see red indicator lights.

The back panel is unmarked, but that

Zoom Telephonics' modem offers advanced V.42 and V.42bis error control and data compression.

doesn't matter, since the two RJ-11 jacks accept the telephone and data line cords interchangeably. The back panel also includes an impedance-matching control.

The special impedance-matching feature helps reduce echo in the phone line and improves your data transmission. You need a small screwdriver and a steady hand to adjust this control, but this is something you do just once. The modem has no manual volume control, but adjustments work with software commands.

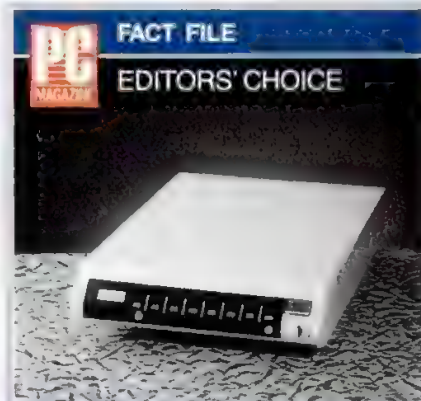
MATCHING UP SOFTWARE

The Zoom/Modem uses a Rockwell RC232AC chip set and stores configuration settings in nonvolatile memory, so you don't have to fumble with any internal switches. You can store four phone numbers of up to 36 digits.

You must supply your own communi-

cations software. The Zoom/Modem V.42bis supports the Hayes Ultra AT command set and provides its own set of extended AT commands. It also supports all of the Microcom commands required for MNP and V.42 operations.

With all of these options, you won't have much trouble finding a communications package. But in order to use the V.42bis feature and MNP 5 protocol, the software must support hardware and software flow control. Since the Zoom/Modem V.42bis is fairly new to the market,

**Zoom/Modem V.42bis**

Zoom Telephonics Inc., 207 South St., Boston, MA 02111; 800-666-6191, 617-423-1072.

List Price: \$299.

Requires: RS-232 cable, communications software.

In Short: The Zoom/Modem V.42bis is a sound choice. Features such as V.42, V.42bis, impedance matching, a solid metal case, and equally solid performance make it a good value.

CIRCLE 622 ON READER SERVICE CARD

only two communication packages specifically list it in their modem menu selections: *Carbon Copy* and *pcAnywhere*.

Zoom offers free support on a toll line, along with BBS support. The modem has a two-year warranty.

You won't go wrong buying this workhorse modem, loaded with V.42bis and other features. It's appropriate for both casual and high-powered modem users. ■

R. Dennis Boatner is a computer consultant working in northwest Florida. Mike Byrd is a frequent contributor to PC Magazine. Frank J. Derfler, Jr., is workgroup systems editor of PC Magazine. Kimberly Maxwell is a newspaper journalist and frequent contributor to PC Magazine. Lisa Cady Newell has experience in systems integration and customer support for both PC and mainframe systems. M. Keith Thompson is a network consultant and frequent contributor to PC Magazine.

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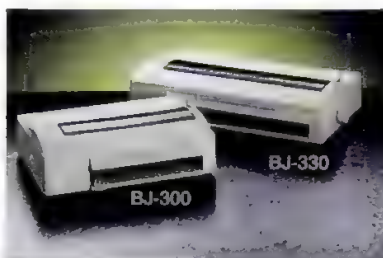
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WHAT SERVICE!

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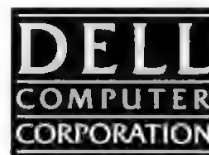


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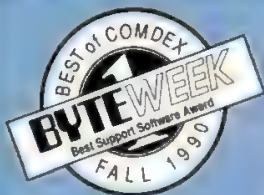
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SYSTEM SETUP

THE Inside Story

by Jim Seymour

It isn't that you don't know how to get under the hood of your PC when you need to check something such as a COM setting or an interrupt request assignment: opening the clumsiest chassis usually involves nothing more than pulling out five or six screws and wriggling the cover off. And it isn't that you're intimidated by the job: you've installed more than a few cards in your day and maybe even swapped a power supply.

The problem is that it's so damned time-consuming and inconvenient to find the right screwdriver, turn the chassis around or squeeze in behind the desk, slide the cover off, pull cards, reinsert the cards, write down the information you need, and then rebuild the PC; that is, assuming you didn't misplace the screws or drop something.

You may be able to tell which COM port the fax card is set to use, count memory chips, and find a math coprocessor while you're under the hood. And for things such as environment size and the details of your FILE and BUFFER statements, it's easy enough to type your AUTOEXEC.BAT and CONFIG.SYS files. But what are you going to do when you need to know which IRQ your optical disk drive is using, or how your mem-

What's going on in your PC? These 11 system setup and reporting utilities illuminate the configuration of your components and tell you if it's the best possible setup.



ory manager divvied up your 3MB RAM into conventional, expanded, and extended memory? And what about your video ROM? Has it actually been remapped into fast RAM?

That's when you need a snoop utility—or a system setup and reporting utility, if you prefer.

AN ODD LOT

Last summer we looked at several diagnostic utilities ("Memory Diagnostic Software: Pinpointing RAM Ailments," *PC Magazine*, August 1990). Some of them reported what they found installed in your PC, and others tried to determine how those system resources were being used. But those findings were secondary to the real purpose of diagnostic programs: figuring out what has gone wrong.



EDITORS' CHOICE

- InfoSpotter
- Manifest

Manifest stands out above all other setup utilities, not merely for its clarity, accuracy, and comprehensiveness, but also for its honesty. It reports on almost everything in your system, and it never pretends to report on anything it doesn't know directly. Its elegant interface, optional TSR mode, and useful optimization suggestions only add to its value. It tells you virtually everything you want to know about memory except for UMBs provided by memory managers not made by Quarterdeck.

Where *Manifest* neglects some details, *InfoSpotter* fills in with its detailed and clearly defined readings from your hardware and BIOS. *InfoSpotter* works with all high memory managers (a feature it shares with *Check-It*; *Manifest* and *ASQ* work best with *QEMM-386* and *386MAX* respectively). Although *InfoSpotter* isn't always accurate, its few errors tend to be obviously wrong (impossibly high numbers, for example) rather than dangerously plausible. Like *Manifest*, *InfoSpotter* can be run as a TSR so you can search for conflicts while other programs are running.

Honorable mentions go to *ASQ* and *System Sleuth Analyzer*. *ASQ* provides almost as much detail as *Manifest*, although it fails to read the sys-

tem directly to find out about files and buffers. It can't be run as a TSR nor is its interface as dynamic as *Manifest*'s, but this free program should be in everyone's toolbox.

System Sleuth Analyzer, while far less impressive than rival packages in most areas, at least tries to identify processor I/O port usage. This can be dangerous and uncertain, but nobody else even makes the attempt, and the ability to avoid pulling boards to read DIP switches is invaluable.

CheckIt and *QAPLus* have their positive points but in terms of the breadth of information provided and the smoothness of the interface, they just don't stand up to *InfoSpotter*.

Control Room is an eclectic product whose main redeeming value is its ability to provide databases of systems on a network. The version of *WinSleuth* we evaluated has a pretty face but not a lot of functionality—since *Microsoft Windows* tries to protect the hardware from applications, it can't report on much.

As for the three popular utility packages—*Mace*, *Norton*, and *PC Tools*—*Norton*, with its *SysInfo* program, does the best job of system reporting, though none of these three pretend to be primarily a setup and reporting tool.

Tools packages are multipurpose utility toolkits, which most people buy for functions other than system reporting. We've included them here since you probably use them now and want to know if they do all the snooping you need. Likewise, *Manifest* can be bought with *QEMM-386*, and *ASQ* is a product of Qualitas, the *386MAX* people. Both *QEMM-386* and *386MAX* are memory managers and include analysis and reporting features primarily to help set up memory most efficiently. A LAN memory manager, Helix Software's *NetRoom*, includes a utility called *Discover* that also does some system reporting. (Smith-Brittain's *PSView*, which reports on the setup and configuration of PS/2 machines, was also requested for evaluation but was not submitted.)

In fact, you may find (as our reviewers did) that no single system setup and reporting program meets all your needs, and therefore you may prefer to assemble your own personalized toolkit that consists of two or more complementary packages.

NOT FOR BEGINNERS (ONLY)

One notion should be squelched right away: that these programs are primarily for beginners and PC neophytes. Actually, the opposite may be true; it takes some PC savvy to recognize the need for what these programs deliver, and often, real technical knowledge to know what to do with the data they provide.

The popularity of these packages among corporate PC managers is a good example of that high-level usefulness. Certainly, the people who set up, install, and support fleets of 500 or 5,000 PCs aren't afraid to pry open computers, but they also haven't got time to do it.

The packages' capability to print a report of their findings is also invaluable for corporate computing managers. They can run a snooper's profile on every machine when it's first configured, and then maintain a central file of those reports. Then, when those micro managers are looking at the hardware upgrades necessary to support new software, for example, they can turn to that file to check the amount of memory installed in each machine or locate the machines with a free COM port for a mouse.

For hardware upgrades, the central file lets them preset interrupt choices, DMA channels, and COM ports on new boards before they have to be sent out to be installed—perhaps by the user of the

machine—with a high degree of confidence that they'll actually work.

Even newcomers to the world of PCs will find value here. One program, *Control Room*, is aimed especially at new users, with its lengthy on-screen explanations, which can be so valuable to the novice that they earned the package a *PC Magazine* Best of 1989 nod last January. Unfortunately, *Control Room* talks a good game, but doesn't deliver. Of all the packages tested, it may provide the least, and least useful, setup and configuration information. (On the other hand, *Control Room* is much more than just a system reporting tool; if you need its other features, such as disk caching, you may see its configuration information as a marginal-value bonus.)

WITH A GRAIN OF SALT

Unfortunately, too often you can't take the information provided by these programs at face value. We found that even the best packages overlooked I/O ports, misidentified processors and coprocessors, declared IRQs in use when they weren't and free when they were in use. This frequently happens because the programs simply read the system areas of memory and assume the BIOS got it right, instead of querying the hardware directly.

The Mace Utilities, *InfoSpotter*, and *WinSleuth*, for example, all read the memory, not the hardware—and therefore, found a math coprocessor in machines that didn't have one. *QAPLus* not only found a nonexistent coprocessor, it reported that it was a Cyrix chip, not an Intel!

Determine the kind of system information you really need, and read these reviews closely to make sure you choose a package with accurate reporting in that area. Since there's so much overlap in the areas covered by these packages, you may also want to base your decision on human-factor issues such as interface design. *Manifest* is the clear winner here: everyone who sees it wonders why other programs can't use such clear and attractive screens. *InfoSpotter* is a close second—no small trick, given the wide range of information the program sniffs out.

HELPING THE HELP DESK

One of the most important uses for snoop packages is to help you get better, faster answers when you call tech support desks with a problem. Whether that help desk is maintained by a PC support staff inside

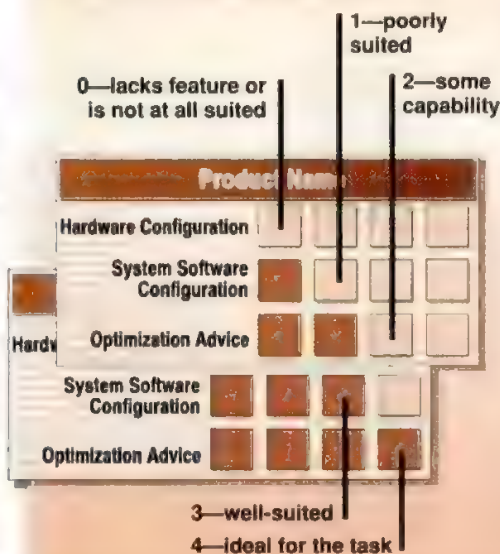
your company, or you're calling a vendor directly for help, you're likely to be asked about the statements in your AUTOEXEC.BAT and CONFIG.SYS files, the amount of memory in your machine, and TSR programs and where

The tech runs the setup and configuration software via the remote-control program and can see on his own screen not only the user's problem but also the results reported by the snooper. The only limitation is that both machines must be equipped with modems, for dial-up access; or must at least be on networks with



SYSTEM REPORTING SOFTWARE: SUITABILITY TO TASK

PC Magazine assesses and assigns a point value to system setup and reporting software in three areas: Hardware Configuration, System Software Configuration, and Optimization Advice. These subjective ratings, based on a scale from 0 to 4, are presented along with each review and translate as follows:



For **Hardware Configuration** purposes the reporting software should be able to report not only the easily detected aspects of a computer system, such as memory size, type, and number of input/output ports, but also aspects such as hardware IRQs used by expansion devices and advanced hard disks that use special sector translation schemes. This information is essential for detecting existing hardware conflicts, for avoiding new conflicts when installing new equipment, and when trying to repair or optimize disks.

For **System Software Configuration** purposes, the reporting software should be able to recognize the presence of device drivers and TSRs in conventional, expanded, and extended memory, and the upper memory blocks (UMBs) between 640K and 1MB. The software should also be able to report which interrupts and file handles are in use. Ideally, it should do all of this as a TSR so that it can make its report while other applications are running.

Optimization Advice provided by a system reporting package should include specific suggestions for adjusting DOS configuration settings, such as buffers and stacks, for altering the DOS environment size, and for resolving conflicts between expansion cards or ports.

they're loaded in memory.

If you have a snoop utility available, consider running it before calling, and make some notes or print out what it finds, so you have that information at your fingertips when the representative starts asking questions. At the very minimum, if you haven't (or can't) run the program before you call, tell them that you have it; most tech support staffers are familiar with the main snooping packages and may ask you to run yours to get that one critical piece of information they need.

Some companies take that a step further. They install a company-standard snoop program on every PC before it's delivered to the user's desk—and sometimes, a remote-control program goes on the machine's hard disk, as well. That way a caller with a problem can let the help-desk tech literally take-over his PC.

dial-up communication servers, or direct LAN bridging.

DANGER, WILL ROBINSON!

There's something especially satisfying about using the computer itself for this sort of work. Looking around to see what's installed inside a computer and how it's being used is exactly the sort of job we should expect computers to handle; that these programs allow a PC to examine its own innards is even better.

In the best of all worlds, the kind of system setup and configuration reporting offered by these programs really ought to be built into the PC itself. A ROM-based setup and configuration routine could provide information with greater accuracy, since the system vendor could fine-tune that code to the nuances of the specific machine. The elimination of reports

of wrong processors, phony ROM dates, or imaginary coprocessors would be one result; another would be that we'd be inclined to check and use this information more often.

As a second-best bet, these snooping features ought to be found in the operating system. From the beginning DOS has provided only the most primitive and feeble assessment tool—CHKDSK comes to mind—and there is little indication of that changing. DOS 4.0 introduced the MEM command, which provides very basic reporting of how system memory is allocated.

Until that day when hardware manufacturers and/or operating system developers decide we can be trusted with that kind of information, and understand just how much we need it as we configure and reconfigure our machines to accommodate IRQ-stealing components and peripherals, these snoop utilities are your best bet.

The only trick is to decide which one, or more likely, which ones you need on the shelf to help untangle your configuration knots. My guess:

You won't be able to live with just one.

ASQ

by Barry Simon

The ongoing fight for dominance of the 386 memory manager market has long been a war between Qualitas' 386MAX and Quarterdeck's QEMM-386. As part of its latest salvo, Qualitas is offering its ASQ reporting program as freeware on CompuServe (type GO PCVEN for the PC Vendors forum) and on PC MagNet (in Library 2 of the Utilities forum), and is distributing it to users groups. The actual cost is a few advertisements in the program for other Qualitas products; other-

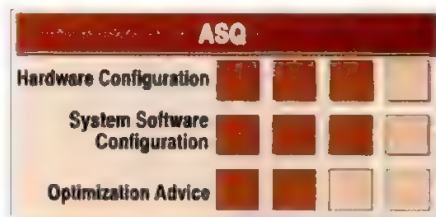
UTILITIES **SYSTEM SETUP & REPORTING**

wise there are no strings attached.

ASQ's main menu displays choices for information on Qualitas products, a superb tutorial on memory issues, and a Systems Analysis Menu where the actual reporting is done. The Analysis selection calls a new screen where you choose Memory Analysis, Configuration Analysis, Hardware Analysis, and System Tuning.

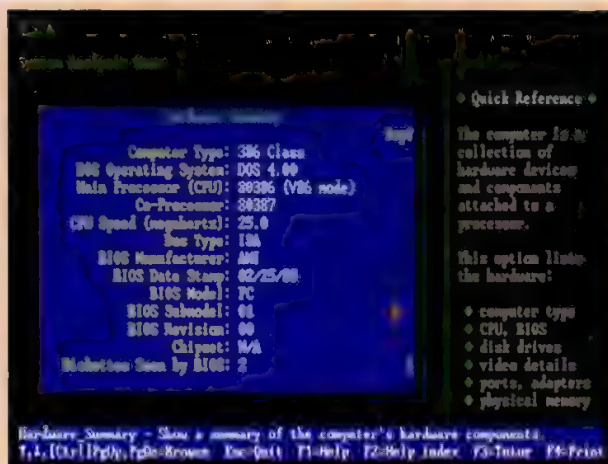
INSIDE THE SYSTEM

The Memory Analysis report includes all aspects of system memory: total and free memory in conventional, expanded, and extended memory, EMS version number and EMS program blocks in use, and a list of interrupts arranged by controlling pro-



ASQ found the last configuration in CONFIG.SYS rather than the one we chose, so it confidently reported 60 file handles rather than the actual 30.

The Hardware Analysis starts with a summary including CPU, DOS version, coprocessor, CPU speed, bus type, system BIOS information, ports, and video summaries. There is a detailed Port submenu item that lists the I/O addresses of the serial and parallel ports, but there is no information provided on game ports. You



This is one of several screens in ASQ's extensive hardware configuration summary.

gram and by interrupt number. ASQ identifies areas of ROM, but other than for system ROM it makes no attempt to identify the copyright or ROM purpose. UMBs are reported properly only if you are using a Qualitas memory management product. The software also times memory speeds and provides information on the XMS driver.

Configuration Analysis displays the contents of your CONFIG.SYS and AUTOEXEC.BAT files and lists the number of file handles, FCBs, buffers, and the programs that currently have open files. However, ASQ cheats on its report of available file handles and buffers. Instead of getting the information via undocumented features of DOS, it searches your CONFIG.SYS file. ASQ failed this test on our system using BOOT.SYS, a program that places multiple startup configurations in the same CONFIG.SYS file.

can retrieve additional information on disk drives, video, CMOS memory, and the BIOS data area.

ASQ includes mouse support, extensive help (context-sensitive and indexed), and the ability to print reports to hard disk or printer. ASQ's advice section is limited in helping you optimize your system, but the Qualitas memory managers include an excellent Maximize program for configuring memory.

An updated version of ASQ that was not available in time for this review, but is expected to be available this spring, will allow you to save system information to a file that another system running ASQ can load.

ASQ doesn't have the same verve as *Manifest* and it may deceive you about files and buffers, but on balance it is a superb reporting tool—and you can't beat the price.

PC **FACT FILE**

ASQ, Version 1.1

Qualitas Inc., 7101 Wisconsin Ave., Bethesda, MD 20814; 800-733-1377, 301-907-6700.

List Price: Free through user groups, bulletin boards, PC MagNet.

Requires: 360K RAM, DOS 2.0 or later.

In Short: This program is a strong reporting tool with an excellent tutorial on memory issues—even with a price tag it would be a competitive package.

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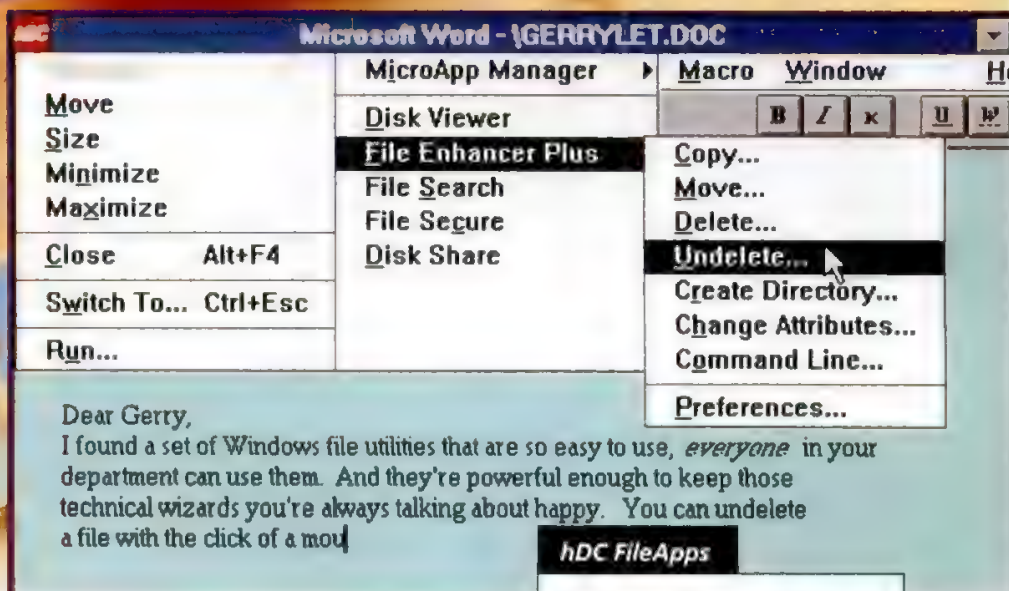
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CIRCLE 528 ON READER SERVICE CARD

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CheckIt

by Barry Simon

CheckIt, TouchStone Software's \$149 reporting and diagnostic program, provides solid but uninspiring reporting capability, as well as diagnostic tests, benchmark tests, and program configuration information accessible via drop-down menus.

CheckIt's interface is flat, partially because you can't change the color scheme, and it lacks the snazzy look of *InfoSpotter* or *Manifest*. You can output reports to disk or printer, but only by two awkward procedures: either turn on report logging and then hit F2 for those screens that you want to log, or select a

disk sizes, parallel and serial port I/O addresses, and mouse and joystick status.

However, second monitor information is missing for two-monitor systems, and it found the joystick on our test machine only if we pushed the joystick to a corner while *CheckIt* was loading. *CheckIt* did pass a rigorous test that we tried on all of the packages evaluated here: changing the equipment byte that BIOS keeps to indicate a math coprocessor in a system that doesn't really have one. We expect the software to read the hardware directly—as *CheckIt* did—and not use this byte. *QAPLUS*, *Mace Gold*, and *InfoSpotter* failed this test and its corresponding test in which we turned off the coprocessor bit in a machine that in fact



CheckIt's hardware configuration screen displays a complete summary of memory, drive, and port configuration.

complete report and press Esc for each test you want to skip.

DIAGNOSTIC CHECKS

The main SysInfo menu includes submenus for Configuration, Memory Map, Interrupts, CMOS Table, and Device Drivers. In a single summary screen, the Configuration report gives you DOS and EMS versions, BIOS manufacturer and date, processor, and coprocessor. It also reports on total and available conventional, expanded, and extended memory, the active video adapter, floppy and hard

had a coprocessor chip installed.

CheckIt's memory map interface displays a list of memory areas by address. Hitting Enter on a particular area opens a box with more information on that region. Included are reports on your software interrupt table, conventional memory-resident programs, programs loaded in UMBs with *QEMM-386* or *386MAX*, and ROM areas including video and adapter ROM as well as system ROM. On one test system with monochrome and VGA monitors, *CheckIt* failed to find a small 24K program area tucked just above the monochrome adapter video RAM. No information is provided on EMS handles, DOS files, FCBs, or buffer usage.

IRQ AND DMA EXAMS

CheckIt's Interrupt report describes IRQ and DMA usage. It is not clear to us how it can locate DMA usage other than the



FACT FILE

CheckIt,
Version 3.0
TouchStone
Software, 2130 Main
St., #250, Huntington
Beach, CA 92648;
800-531-0450, 714-
969-7746.
List Price: \$149.
Requires: 384K
RAM, DOS 2.1 or
later.

In Short: *CheckIt* has adequate reporting features, but gaps in software and hardware reporting make its competitors look better. Most notable for its suite of diagnostic tests.

CIRCLE 418 ON READER SERVICE CARD



two standard channels: cascade and floppy disk. Indeed, it missed DMA assignment by a tape backup drive that was inactive while *CheckIt* was running. It was able to determine that the mouse was on IRQ 4 on the test machine, presumably by correlating it with the mouse driver. This was something many other packages missed, notably *Manifest*, which noted the IRQ was assigned to a DOS area, where the driver chain resides.

The CMOS table report reads CMOS information, but the only item you can edit is the current date/time. The Device Driver report describes your device driver chain.

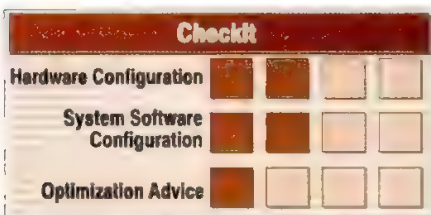
CheckIt, as well as the other programs, didn't detect that our Sound Blaster card was using IRQ5. Since you don't load a CONFIG.SYS driver for the card, and no interrupts were issued while *CheckIt* was running, it would have been impossible to detect the IRQ use. The moral to the story is that none of these packages are as accurate on IRQ and DMA reporting as their displays might lead you to believe.

CheckIt is one of the leading reporting programs in distribution and sales. While strong in benchmark tests and diagnostics, it doesn't clearly stand out among the system setup and reporting competition.

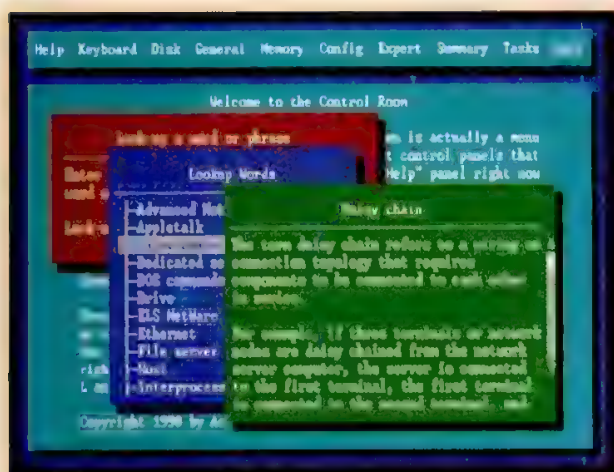
Control Room

by Barry Simon

Ashton-Tate's \$129 *Control Room* utility is a limited collection of setup and reporting tools, including network capability and complete on-line help, that examine many aspects of your system. What *Control Room* is missing, however, is more



UTILITIES SYSTEM SETUP & REPORTING



Control Room's most notable feature is its excellent on-line glossary and help system. No other setup package is as instructive.

significant than what's there.

In the area of memory reporting, the program examines total and available conventional, expanded, and extended memory and lists the owners of conventional memory blocks. If you load an optional resident utility, it will also report on the owners of EMS and XMS blocks. If this is not loaded, it lists the owners of these blocks as "unknown."

INCOMPLETE REPORTING

Control Room's memory reporting also includes information on wait states and a CPU memory cache, reports that no other reporting program provides. Missing elements include lists of interrupts, information on UMBs (if you have a memory manager), ROM (other than system ROM), as well as information on your device driver chain, DOS file handles, and DOS buffers.

Hardware reporting is also incomplete. *Control Room* does report on the parallel ports, serial ports, and the coprocessor. It also recognized that the disk on our main test system was not MFM. But it provides no information on IRQs, game ports, or bus type.



Moreover, it was confused by several nonstandard features in our test machine equipped with both VGA and monochrome adapters. *Control Room* reported that "the second display, the MDA, is the display that is currently active and being updated by this program." It was actually the color monitor that was active.

The XMS manager on this machine caused *Control Room* to fumble again: on a machine with 15MB of extended memory, it reported only 9.6MB. *Control Room* reports proxy drive letters set up with DOS's Subst command as if they were legitimate hard disks. Besides the reporting module, there are many features including keyboard macros, disk caching, file encryption, DOS command-line editing, and screen blanking.

Like everything in the package, *Control Room's* reporting is a mixed bag. On the positive side, if you are on a network, you can have *Control Room* provide summary information for each machine on the network on a regular periodic basis. Ash-

ton-Tate provides templates to automate moving this information into *dBASE*. On the negative side, if you want a complete report, you have to pick the oddly named Expert option and generate an ASCII file. For one of our test machines this was a whopping 26K, complete with gems like the comment stating that the 600MB drive was "certainly large enough for every conceivable single-user application." The program desperately needs a reporting option with more detail than its summary, but without all the chatter.

MACHINE-SENSITIVE HELP

Control Room's documentation is exceedingly brief. You could mistake the 26-page picture-filled manual for an advertisement and wonder what happened to the real manual. Ashton-Tate clearly assumes that the excellent on-line help is a replacement for the manual, but you can't browse through on-line help the same way you can a manual.

Control Room's thorough help is context-sensitive as well as machine-sensitive. If you ask about an item like EMS, the program will give you the version number of the EMS driver on your particular machine. You can also search for topics by key words. If you run a search on "network," you'll get 31 entries. The help and report components are tutorial by nature and provide complex information clearly.

The help panels slither diagonally onto the screen, producing an interesting effect at first. You can turn the effect off, but the method for doing so is obscure. You'll need to start *Control Room* with the /o parameter and change display speed from "high" to "BIOS."

Control Room's advantages are in its integration and ease of use. If you've dreamed about having a virus checker, a disk cache, a keyboard customizer, a printer redirector, and a screen blanker all in the same place, *Control Room* will become a good friend. Unless you find the idea of network reporting attractive, you'll want to look elsewhere for advanced reporting software.

InfoSpotter

by Edward Mendelson

InfoSpotter isn't as well-known as most of its competitors in the field of setup and reporting utilities, but fame is less useful



Control Room,
Version 1.0
Ashton-Tate Corp.,
20101 Hamilton
Ave., Torrance, CA
90509; 213-329-
8000.
List Price: \$129.
Requires: 384K
RAM, DOS 2.0 or
later.

In Short: This package is a utilities grab-bag with keyboard macros, caching capabilities, a screen blanker, and reporting features. The on-line help with a wonderful glossary of computer terms is the high point of the program.

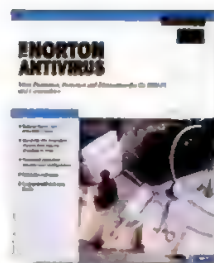


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CIRCLE 264 ON READER SERVICE CARD

PC FACT FILE EDITORS' CHOICE

InfoSpotter,
Version 2.5
Merrill & Bryan, 9770
Carroll Center Rd.,
Suite C, San Diego,
CA 92126; 619-689-
8611

List Price: \$79.95.

Requires: 256K

RAM (150K free).

DOS 2.1 or later.

In Short: A very powerful and accurate system reporting utility, this program lacks only low-level disk formatting details. It provides extremely detailed memory reports and the ability to work with any memory manager.



CIRCLE 420 ON READER SERVICE CARD

than intelligence when you're trying to learn about the inside of a PC. Merrill & Bryan's \$79.95 package is one of the most careful, ambitious, and thorough reporting tools around. When you see the information it ferrets out of your machine, you'll probably want to replace the utilities you use now.

EVERY IMAGINABLE DETAIL

Like *Manifest*, *InfoSpotter* can run as a standalone application or as a TSR so that you can pop it up and find conflicts while they occur. In either mode, there's very little information that it can't spot, and in many cases, allow to you change. The clearly-arranged drop-down menus show virtually every imaginable detail about your BIOS, CMOS, I/O and video ports, plus exceptionally thorough information on software interrupts and hardware IRQs. A startup option lets you display COM3 and COM4 in addition to COM1 and COM2. *InfoSpotter* was almost alone in its ability to recognize that IRQ11 was used on my system with the Intel Satisfaxion board. On one of our test machines, however, it occasionally caused a cold reboot when it attempted to list DMA assignments.

Its memory reporting is exceptionally thorough, with an optional startup switch that gives you a full survey of upper memory addresses that let you make the fullest use of 386 memory managers. It has no trouble identifying programs loaded in UMBs by any 386 memory manager, unlike *Manifest* and *ASQ*, which are fully successful only with *QEMM* and *386MAX* respectively. If you run *InfoSpotter* from the DOS prompt—instead of popping it up as a TSR—it intelligently leaves itself

SYSTEM SETUP & REPORTING

out of its own report on DOS memory usage, so you can see what your RAM will look like after you exit the program and go on with your work.

InfoSpotter lets you display the contents of anything in memory, including expanded memory and XMS memory. It provides full plain-English displays of the BIOS data area and CMOS, and even lets you edit the CMOS. You can also edit CONFIG.SYS and AUTOEXEC.BAT files, and add up to four of your own programs to the package's menus.

The program comes with a library of information on common BIOSs and MCA POS adapters, which it uses when making positive identifications. An extensive help system makes it easy to maneuver your way through the program's wide range of choices. You can print a partial report (or send it to a file) from any submenu or any of the main menu items (Memory, BIOS, etc.), or you can tell the program to create a full report. You can also get useful optimization hints similar to those provided by *Manifest*.

TORTURE TEST

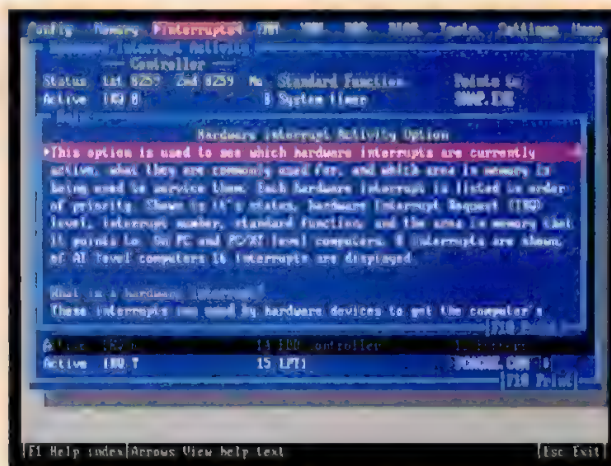
InfoSpotter doesn't try to report on everything. It doesn't identify SCSI or ESDI



by the test in which we twiddled the coprocessor equipment byte so that the machine claimed to have a 8x87 chip that in fact wasn't really there. On one test machine, the program got confused by something in the DOS area and reported nonsensical figures for the size of DOS itself. But this is in an area where no one else even attempts to report similar levels of detail. It got similarly confused by the presence of *Software Carousel*, a task switcher.

Although the program never had any trouble reporting the size of the environment, it was unable to display COMSPEC and the rest of the environment in two systems that had *QEMM-386* installed and reported that DOS had no environment table. This was especially strange because I was able to shell out to DOS from the *InfoSpotter* table and get this information simply by typing SET at the command line.

InfoSpotter's manual is lucid and com-



InfoSpotter's drop-down menus include help screens with lucid explanations of the hardware and software information that the program provides.

hard disks, although it gives exhaustive details on partition tables, and even shows you what you would see if you examined the disk in FDISK. Oddly, it doesn't try to tell you the processor speed of your CPU. On our test systems, it committed some minor errors. On one test system it failed to locate the joystick connected to the Sound Blaster card (only *QAPLUS* passed this test). More surprisingly, it was fooled

plete, but lacks an index. A stapled addendum updates the manual for the release we examined, Version 2.5, but the manual itself should have been reprinted. These, however, are relatively trivial complaints about one of the very few programs that provide an advanced and complete solution to the reporting needs of any computing environment. Take a good look at *InfoSpotter*.



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AE-2 MC Ethernet is software compatible with Novell's NE/2000 hardware, you can run Novell "out of the box."

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UTILITIES

SYSTEM SETUP & REPORTING



SYSTEM SETUP AND REPORTING SOFTWARE: SUMMARY OF FEATURES

Products listed in ascending price order

	ASQ	Manifest	InfoSpotter	System Sleuth Analyzer	Control Room	CheckIt
List price	Free	\$59.95	\$79.95	\$79.95	\$129.00	\$149.00
MEMORY REPORTS						
Conventional memory	☒	☒	☒	☒	☒	☒
EMS	☒	☒	☒	☒	☒	☒
EMS blocks	☒	☒	☒	☒	☒	☒
Extended memory	☒	☒	☒	☒	☒	☒
Himem driver (active or inactive)	☒	☒	☒	☒	☒	☒
Program blocks	☒	☒	☒	☒	☒	☒
UMBs	☒	☒	☒	☒	☒	☒
UMB program blocks	☒ (with 386MAX)	☒ (with QEMM-386)	☒	☒	☒	☒
ROM	☒	☒	☒	☒	☒	☒
Timings	☒	☒	☒	☒	☒	☒
PORT REPORTS						
Parallel ports	☒	☒	☒	☒	☒	☒
Serial ports 1 and 2	☒	☒	☒	☒	☒	☒
Serial ports 3 and 4	☒	☒	☒	☒	☒	☒
Game ports	☒	☒	☒	☒	☒	☒
Mouse port	☒	☒	☒	☒	☒	☒
HARD DISK REPORTS						
Hard disk type (MFM, SCSI, ESDI)	☒	☒	☒	☒	☒	☒
Hard disk size	☒	☒	☒	☒	☒	☒
Partitions	☒	☒	☒	☒	☒	☒
SCSI translations	☒	☒	☒	☒	☒	☒
ESDI translations	☒	☒	☒	☒	☒	☒
ADAPTER REPORTS						
Video adapter	☒	☒	☒	☒	☒	☒
Second video adapter	☒	☒	☒	☒	☒	☒
Network	☒	☒	☒	☒	☒	☒
CD-ROM	☒	☒	☒	☒	☒	☒
LOW-LEVEL HARDWARE REPORTS						
IRQs in use	☒	☒	☒	☒	☒	☒
Processor ports	☒	☒	☒	☒	☒	☒
Processor speed	☒	☒	☒	☒	☒	☒
Coprocessor	☒	☒	☒	☒	☒	☒
CPU type	☒	☒	☒	☒	☒	☒
Bus type	☒	☒	☒	☒	☒	☒
BIOS date and manufacturer	☒	☒	☒	☒	☒	☒
DOS INFORMATION						
DOS version	☒	☒	☒	☒	☒	☒
Number of file handles	☒	☒	☒	☒	☒	☒
File handles in use	☒	☒	☒	☒	☒	☒
Buffers	☒	☒	☒	☒	☒	☒
Interrupt table	☒	☒	☒	☒	☒	☒
COM port parameters	☒	☒	☒	☒	☒	☒
INTERFACE						
Configurable interface	☒	☒	☒	☒	☒	☒
On-line help	☒	☒	☒	☒	☒	☒
RAM-resident capability	☒	☒	☒	☒	☒	☒
REPORT OUTPUT						
Output to disk	☒	☒	☒	☒	☒	☒
Output to printer	☒	☒	☒	☒	☒	☒

Editors' Choice ☒—Yes ☐—No

N/A—Not applicable: This feature does not apply in the Windows environment.

UTILITIES SYSTEM SETUP & REPORTING

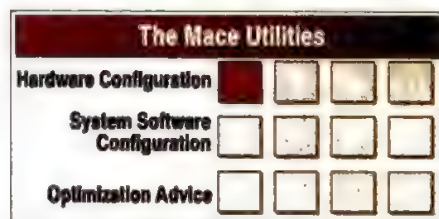
The Mace Utilities

by Edward Mendelson

The Mace Utilities does many things well, but no one has ever suggested that you should use the package as anything other than a set of disk utilities. The System Statistics program is one of the weakest elements of Fifth Generation System's \$149 package.

SURFACE EXPLORATION

All you get is a single screen that tells you the type of machine you have, the number of floppy and hard disks and ports, and a brief report on memory. *Mace*, like *PC Tools* and the first release of *The Norton Utilities*, Version 5.0, tells you your



machine is an IBM AT, even when it has a 386 processor, and *Mace* correctly reports that it has a non-IBM BIOS. By artificially switching the coprocessor equipment byte you can trick *Mace* into telling you that you have a math coprocessor when you really don't.

Mace's awkward but powerful sector editor, MUSE, can give you full statistics on your disks, but doesn't explore as deeply as the partition table and doesn't report whether you're using MFM, ESDI, or SCSI disks. Nothing in the *Mace* package



FACT FILE

The Mace Utilities,
Version 1990
Fifth Generation
Systems, 10049
North Reiger Rd.,
Baton Rouge, LA
70809; 800-873-
4384, 504-291-7221.
List Price: \$149.
Requires: 256K
RAM, DOS 2.0 or
later.



In Short: *Mace's* minimal system statistics screen doesn't report much and can easily be fooled. You should buy this package for its strong DOS utilities, but not for its reporting capabilities.

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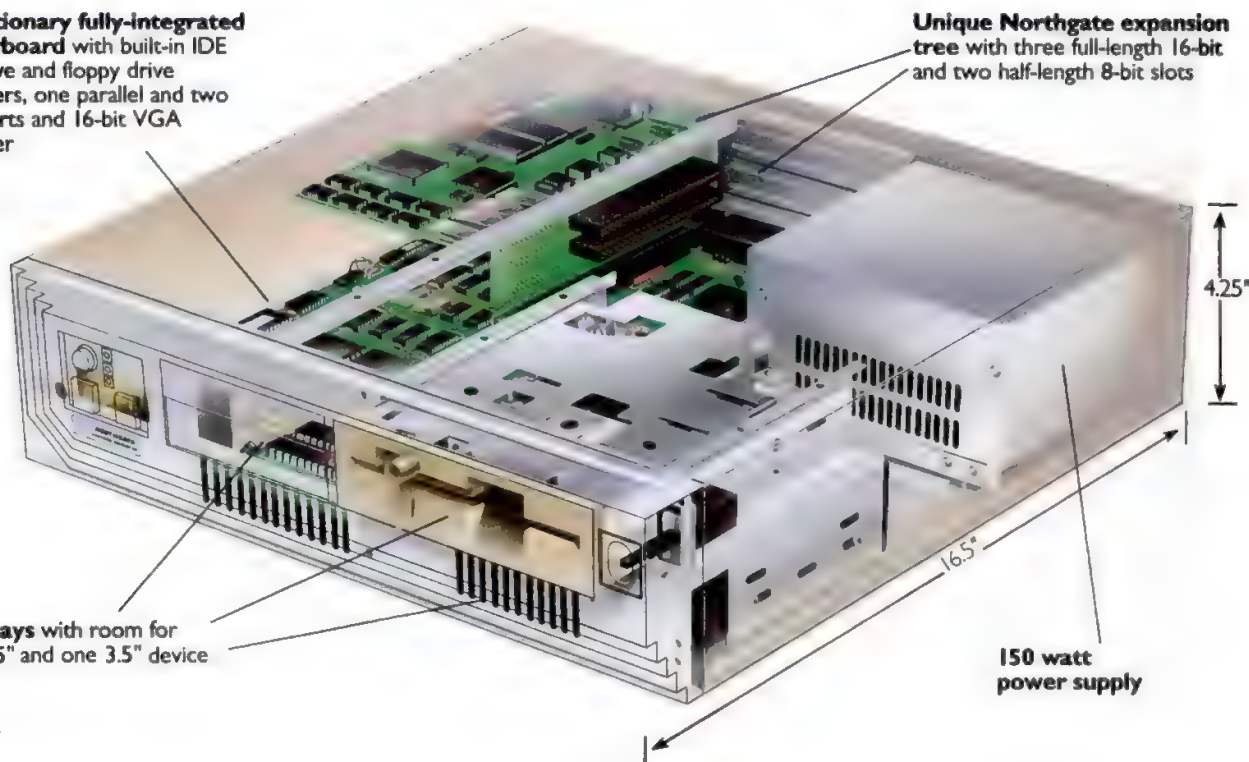
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August 14, 1990

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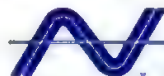
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UTILITIES

SYSTEM SETUP & REPORTING



The Mace Utilities' system-information screen displays basic details about your computer's setup. No help screens or other options are available.

tries to tell you which programs are in DOS, expanded, or extended memory.

The System Statistics program doesn't have a help screen, and if you want a report on the contents of your system, you can get one by pressing **PrtSc**. *Mace* can do a lot to protect your system from damage and recover lost files, but don't expect it to tell you everything you might want to know about your hardware resources or DOS configuration.

Manifest

by Barry Simon

Quarterdeck Office Systems' reporting utility, *Manifest*, is a model of intelligent software design. The program is available standalone for \$59.95, bundled with Quarterdeck's 286 memory manager *QRAM* for \$79.95, with *QEMM-386* for \$99.95, or with *DESQview 386* for \$219.95. The utility is especially strong on detailed memory reporting.

CLOSE-TO-PERFECT INTERFACE

You can load *Manifest* as a TSR if you want, but it takes a hefty 120K RAM. Its replacement for typical drop-down menus is so smooth and natural for reporting that you'll probably prefer it to the competition. A list of main choices down the left side of the screen includes: System, First Meg, Expanded, Extended, DOS, Hints, and Exit. If you're running *QRAM*, *QEMM-386*, or *DESQview 386*, there is additional information on those programs.

At the top of the screen is a list of subtopics that changes as you make a

subtopic selection. Throughout the program the Up/Down arrow keys change topic and Left/Right arrow keys change subtopic. *Manifest* remembers what subtopic you were on when you return to it. The center of the screen displays the report corresponding to the subtopic chosen. Occasionally, the message "Press PgDn for More" appears. Help is available with **F1** and report printing with **F2**. With excellent mouse support, support for 43/50 lines on EGA/VGA, and intelligent use of color, *Manifest* has a user interface that's close to perfect and provides good control over reports.

DEPTH AND DETAIL

The main system overview screen reports on CPU, coprocessor, video adapter, BIOS maker and copyright date, serial and parallel ports, enhanced keyboard BIOS, and total and available memory in conventional, expanded, and extended memory. The system topic also has subtopics to

display (but not edit) your **CONFIG.SYS** and **AUTOEXEC.BAT** files, the content of CMOS memory, and adapter information. CMOS memory is displayed by byte number or in text form, and no information is provided on game ports.

In the Adapter subtopic, one of the weaker areas, *Manifest* reports on aspects of your hardware not included in the main screen. It reports on your primary video adapter, alternate video adapter if your machine has two, disks, and the current parameters of your serial and parallel ports. The disk report is limited to a single report on each physical disk that includes number, BIOS type, heads, cylinders, sectors, and capacity. No information is provided on how the disk is partitioned, free disk space, or family type (ST506, ESDI, SCSI).

The First Meg menu selection reports on programs, interrupts, and BIOS data area and also performs memory timings. The program listing includes the exact memory area, size in kilobytes, and program name if available. *Manifest* provides this information for programs loaded in UMBs by *QEMM-386*, but not by other 386 memory managers. The content of the BIOS data listing is somewhat technical,



but it displays the information in an easy-to-digest form. The interrupt listing displays by program or by interrupt. On one test machine, *Manifest* correctly associated **INT 33H** to **MOUSE.SYS** when *QEMM-386* had loaded it into UMBs, but not when it was loaded into conventional memory.

The Expanded Memory topic includes reports on total and available EMS memory, the owner of each used handle, real alternate maps, timings, and benchmark tests. There's also a visual map of the location of the page frame. The Extended Memory topic reports on total and free XMS memory, XMS drivers, and XMS handles available. Surprisingly, although *QEMM-386* provided the test system's XMS/EMS and shared them, *Manifest* answered "Unknown" to the question "Shares Memory with EMS."

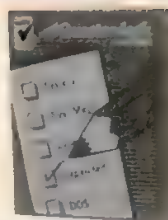
The DOS topic examines memory

FACT FILE

EDITORS' CHOICE

Manifest,
Version 1.01
Quarterdeck Office
Systems, 150 Pico
Blvd., Santa Monica,
CA 90405; 213-392-
9851.
List Price: \$59.95.
Requires: 120K
RAM, DOS 2.0 or
later.

In Short: A well-designed package that reliably reports on most aspects of your system via a user interface that is a pleasure to use.



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UTILITIES SYSTEM SETUP & REPORTING

taken by DOS, number and owners of file handles, number of DOS buffers, the current DOS environment, and the full list of loaded device drivers. The *QEMM-386* and *DESQview* topics are too specialized to report on here.

Enter the Hints section, and you'll get Polonius-type advice that points out, for instance, that you have unused environment space and might want to decrease the size. The hero of optimization is the Optimize program that comes only with the bundled packages. It reboots your machine twice and figures out the best way to use UMBs. *Manifest* combines an elegant interface with detailed reporting

capabilities that provide a complete system reporting solution.

The Norton Utilities

by Edward Mendelson

At the dawn of the PC era a decade ago, Peter Norton's SysInfo program was the best way to look inside a computer without opening the case. Now that Symantec's \$179 *Norton Utilities* has reached Version 5.0, its SysInfo utility is still a



reasonably clear window into a closed PC. It doesn't match specialized programs like *Manifest* or *InfoSpotter* in depth of detail, but it's better than anything you can find in other general-purpose utility packages.

SysInfo, generally known by its optional short name SI, now displays up to 20 screens of information, complete with dramatic-looking exploding windows. The information you get on DOS's 640K is quite thorough: lists of program blocks, device drivers, TSRs (complete with sizes and hooked vectors), and the interrupt table. *Norton* knows if you have expanded or extended memory but doesn't make any attempt to show you what's in it. It offers a summary of memory, video memory, and ROM that it finds in the upper memory region between 640K and 1MB but doesn't offer a detailed map.

IRQ CHALLENGES

While SI's screens are interesting to read—and it's always fun to run the benchmark tests included in the program—you shouldn't rely on this program when trying



Manifest uses color in an intelligent way. Here, the blue text indicates interrupts different from DOS or System ROM.

SHAREWARE SOLUTIONS FOR SYSTEM SETUP

by Barry Simon

Electronic bulletin boards and hard disk vendors provide free and shareware programs that report system information. If you have a modem, the most comprehensive collections are in CompuServe's IBMNET, especially in the IBMSYS and IBMHW forums (from PCMagNet, GO CIS:IBMSYS will take you to IBMSYS).

Don't forget that if you use DOS 4.0, you already have a program called MEM that reports the state of your memory. Running MEM without any parameters gives a simple display of the total and free memory of conventional, extended, and expanded memory. Typing in

MEM /DEBUG

will give a complete listing of memory blocks in use, including program name, program size (but only in base 16!), and

a partial list of your device drivers. You'll also find many system setup programs, including the following three programs, in PC MagNet's Utilities forum.

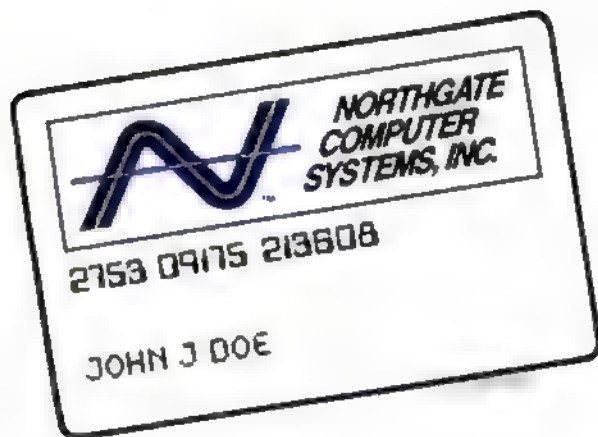
PMAP, Version 2.03, by Chris Dunford is a complete memory reporting utility. It provides a report on memory in use, program name, size, file handles in use, and interrupt vectors controlled—not only for programs in conventional memory but also for programs loaded by a 386 memory manager in high-DOS memory. It will also give a complete report of device drivers, expanded memory, and extended memory.

MAPMEM, Version 2.9, by Kim Kokkonen is part of his TSRCOM collection of programs that control your memory (his Mark and Release programs let you remove resident programs safely from memory). MAPMEM provides a report on program name, size, file handles, and

interrupt vectors controlled for each program in conventional memory. If you load an optional resident program called Watch, you can even get information on entire interrupt chains. A separate program in the package called Device gives a listing of device drivers.

YOURSYS, Version 1.0, by Philippe Rabergeau gives an overview of the state of your computer, including CPU and coprocessor, graphics card, total and free memory (for conventional, extended, and expanded memory), total and free space on each disk drive, and a memory usage list by program. It also displays your CONFIG.SYS and AUTOEXEC.BAT file. If you are trying to get technical support via a BBS, YOURSYS is an ideal vehicle. Just save its report to a file and send the file to the person giving you advice.

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Requires: 512K
RAM, DOS 2.0 or later.

In Short: Norton's SysInfo doesn't probe as deeply as specialized reporting packages, but it offers more information than you get with other disk utility software. It isn't enough to deal with major emergencies, but it gives a good overall picture of your machine.

CIRCLE 499 ON READER SERVICE CARD



SI didn't detect the assignment of IRQ 11 to the Intel SatisFAXtion board in one of our test systems, and didn't detect the assignment of IRQ5 to the Sound Blaster board in another. In one system, it reported that several software interrupts were owned by "free memory" when in fact they were owned by a mouse. It didn't mention the presence of a second video adapter in a two-monitor system.

As you might expect from a package of disk utilities, SysInfo offers a thorough display of disk information, although it doesn't probe deeply enough to determine

whether you're using an advanced ESDI or SCSI adapter. (The Calibrate program in the same package does this.) Norton will also display your CONFIG.SYS and AUTOEXEC.BAT files and display the contents of your CMOS configuration with incorrect values highlighted. You can generate reports of all or part of Norton's information from a conveniently arranged screen.

Although Norton's new interface uses elegant SAA-compliant menus, some cosmetic details remain to be worked out. Norton's TSR listing displays information about each TSR as you scroll through the list, including the full command-line parameters. If a TSR has an especially long command line, the tail end of the line remains confusingly on-screen after you've scrolled to the next TSR.

SysInfo doesn't report everything there is to know about a computer, and it sometimes jumps to conclusions. If you're resolving difficult hardware and software conflicts, it may not tell you what you need to know. But if you want to get a quick look under the hood, *The Norton Utilities* can be both entertaining and enlightening.

PC Tools Deluxe

by Edward Mendelson

PC Tools Deluxe, Version 6.0, is one of the richest and most feature-packed utility packages on the market, but the information the program gives you about your system is not the reason to buy it. For your \$149, Central Point Software gives you a



The Norton Utilities' screens avoid clutter by displaying details about individual items in the bottom part of the screen as you scroll through the list of categories at the top.

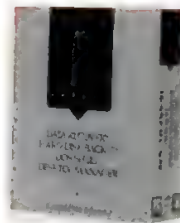


**Central Point
Software, 15220
N.W. Greenbriar
Pkwy., Beaverton,
OR 97006; 503-690-
8090.**

List Price: \$149.
Requires: 512K
RAM, DOS 3.0 or
later.

In Short: *PC Tools* provides little more than a simple screen of information about your computer's configuration. It doesn't help much, but it's accurate enough not to do any harm.

CIRCLE 494 ON READER SERVICE CARD



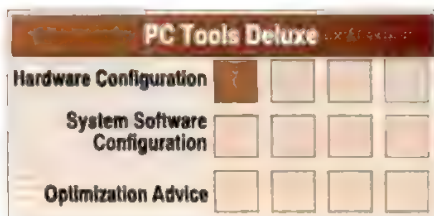
flexible memory-resident shell program, backup, cache, and desktop utilities. You can regard the System Information screen and the Memory Information programs as moderately interesting extras thrown in as a bonus.

JUST THE BASICS

The System Information screen, available from the main PC Shell menu, shows you the basics about your system: the processor (but not its speed), the number of serial and parallel ports, the presence of a math coprocessor, and the amount of DOS, expanded, and extended memory available and in use. *PC Tools* thinks an 80386 system is an IBM AT and not a compatible. (*Norton* made this elementary mistake on the first release of *The Norton Utilities*, Version 5.0, but corrected it in a maintenance release.) It can, however, identify a second monitor (which *Norton* missed in our test system) and the addresses of ROM BIOS extensions in the Upper Memory Area. But the program doesn't tell you enough to help you avoid conflicts.

A separate Disk Info option, also available from the main PC Shell menu, gives you statistics about your disks, but *PC Tools* doesn't distinguish between physical and logical disk drives.

You can get memory information from the PC Shell main menu or from an equivalent program that can be run from the DOS





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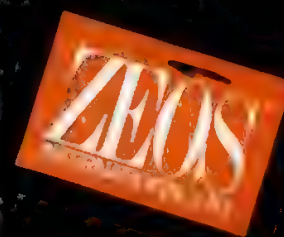
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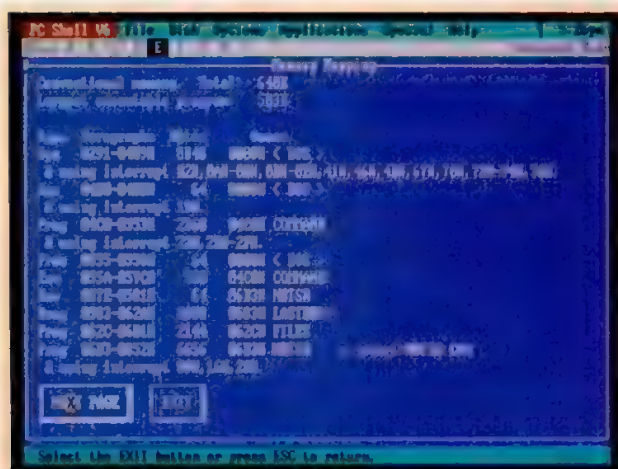
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UTILITIES SYSTEM SETUP & REPORTING



PC Tools Deluxe has two system information screens: the memory map, which is shown here with the option for detailed output, and a basic configuration screen similar to that of the one in *The Mace Utilities*.

command line. By default, the program displays a list of programs in DOS memory and basic statistics about expanded and extended memory. You can also choose to display a full list of DOS memory blocks (including TSRs) and EMS blocks. No information on the contents of UMBs is provided.

There's nothing wrong with *PC Tools'* system configuration information beyond its lack of ambition. If you already have the rest of the package, you may find the system information useful. But you'll need something more ambitious to resolve most hardware and software conflicts.

QAPlus

by Barry Simon

QAPlus, DiagSoft's \$159.95 basic diagnostic package, is one member of a family of "quality assurance advanced diagnostics," including the specialized *QA/Field Engineer* and *QA/Factory*. From *QAPlus's* SysInfo menu you can choose among five reporting selections: DOS Memory Map, Interrupt Info, Hardware Info, Device Driver Info, Environment Info; and two benchmark tests: Disk Performance and System Performance. The hardware information screen is displayed when the

program boots and includes information on CPU, BIOS manufacturer, bus type, free and available memory in conventional, expanded, and extended forms, information on monitors and alternate monitors if present, drives, mouse, and parallel, serial, and game ports.

TESTING RESULTS

Earning distinction, *QAPlus* was the only program to correctly locate the game port on our test system with a Sound Blaster card installed. Of the other packages tested, only *CheckIt* and *InfoSpotter* claim to locate game ports, and they failed our exam. On the negative side, *QAPlus* was one of only three programs that failed our test of twiddling the coprocessor equipment byte. On our system with no coprocessor present, but with the byte changed, it assured us we had a Cyrix coprocessor.

QAPlus displays a list of memory

blocks in conventional memory but not in the UMBs. If you have more than 15 blocks, you have to hit Enter to see the remaining blocks. Then you can't PgUp to the first set without returning to the menu item. (Such unfriendly behavior is not limited to the DOS Type command.)

Among its strong features are interactive tests of mouse, joystick, and keyboard. One area where *QAPlus* performs especially well is IRQ display. It is difficult, if not impossible, for programs to access information about IRQs except when a peripheral is actually issuing in-



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QAPlus,

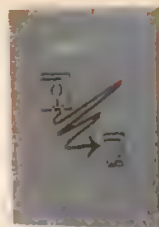
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8247

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RAM, DOS 2.0 or
later.

In Short: *QAPlus* stands out as a reporting package for its excellent mouse and joystick tests.



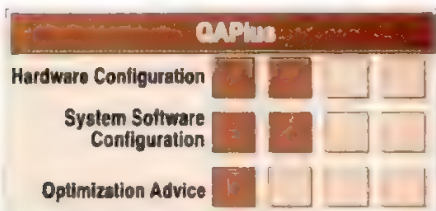
CIRCLE 425 ON READER SERVICE CARD

terrupts. So *QAPlus* does the only intelligent thing to access the mouse IRQ: it asks you to move the mouse! However, it missed the fact that on one test machine IRQ11 was pointing toward hard disk adapter ROM, and like *CheckIt*, *QAPlus* failed to find the DMA channel assigned to a tape backup on that same machine.

QAPlus will also display the DOS device drive chain and the contents of your current environment. We found that with long variables, the display could spill



Included with *QAPlus* is this interactive test for your joystick.

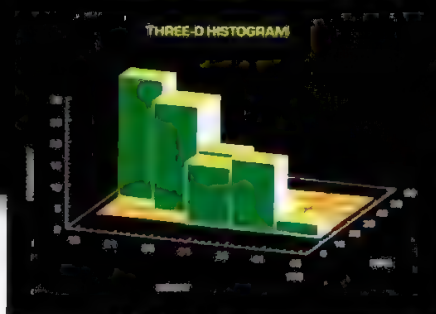
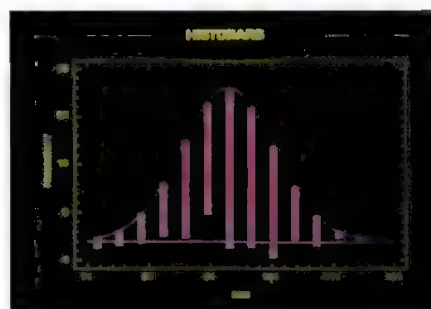


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out of the box allotted to it and remain partially on the screen afterward. This is a purely cosmetic but nevertheless annoying bug.

You won't get much of the capability that you'll find in some of its competitors: information on nonsystem ROM, EMS blocks, DOS file handles, and buffers. Most seriously, there is no display of software interrupts. *QAPlus*'s reporting is less than ideal. You can generate only one report on some, but not all, of the information that you can get from the program. Like *CheckIt*, *QAPlus*'s handling of color is poor. You can have any colors you want as long as you want white on black or cyan on blue.

While *QAPlus*'s handling of mouse and joystick is excellent, the overall reporting is too limited and the interface too awkward for this to be your best choice.

System Sleuth Analyzer

by Edward Mendelson

System Sleuth Analyzer presents a dilemma for anyone in the market for system reporting software. Dariana Technology Group's \$79.95 package gives you crucial information about one aspect of your computer that no other software provides, but for more-complete and reliable information about other aspects, you may do better with its competitors. And the menu system is perhaps the most awkward of all specialized reporting software.

I/O PORT SPECIALIST

System Sleuth is unique in its ability to report on processor I/O ports—the ports

in the low address range of standard-bus systems that are used by many add-in boards, hard disks, and video cards. Anyone with experience installing expansion cards in a PC knows the sinking

feeling when you realize that an expansion card won't work because its I/O address conflicts with one of the existing cards, and the frustration when you try different addresses for the new card without knowing whether the change will introduce a new conflict.

SETUP AND CONFIGURATION: Defining Terms

FILE-RELATED TERMS

FCB File Control Block. This is a region in an application's memory area that contains information about open files that allows DOS to access those files. The FCB file handling scheme was originally introduced in DOS 1.0 and is it maintained today for compatibility.

File handles This scheme, which was introduced in DOS 2.0, replaces FCBs. DOS assigns a two-byte number called a handle to the files and devices needed to run a program and then uses it to access the file or device. In the FILES= directive in your CONFIG.SYS file, you specify the number—between 8 and 225—of system-wide handles that your program needs to access at one time.

Device driver A program that is used to control a piece of hardware; it is run from the DEVICE= directive in your CONFIG.SYS file. Device drivers provide the operating system with detailed instructions about peripherals, such as the number of sectors per disk track or the number of lines of screen resolution, to manage the functions of the peripheral. Basic drivers come with the operating system, but you must install drivers for each peripheral you add.

INTERRUPT-RELATED TERMS

Interrupt When hardware or software requires microprocessor services, the CPU is alerted by an interrupt signal: a special instruction that switches control of the CPU to the operating system. The CPU keeps a set of 256 memory addresses labelled 0 to 255 for this purpose. Some interrupts are generated by hardware, such as a printer, keyboard,

internal timer, or hard disk, and others are used for software to communicate with DOS and BIOS. To call most DOS services, for example, a program calls INT 33.

Interrupt chain When a resident program loads, it often places some of its code into the CPU's address space so that it can be called by an interrupt. To prevent the previous resident of that address space from being shut out, the new owner of the address arranges to call the previous owner when its code is finished. In this way, there is a chain of code for different resident programs and device drivers, each one calling the next one in line.

IRQ Interrupt Request. Instead of dealing directly with the CPU, hardware communicates with one of the programmable interrupt controllers (see PIC below). The eight address lines on the first PIC are labelled IRQ0 to IRQ7 and are mapped by the PIC to CPU interrupts 8 to 15. IRQ0 is always assigned to the system timer and IRQ1 to the keyboard. IRQ2 is used by the two PICs to communicate with each other and IRQs 3 and 4 are assigned to COM1 and COM2. Hard disk requests are generally assigned to IRQ5 on XTs and IRQ14 in 286 and 386 machines.

PIC Programmable Interrupt Controller. The 8259A chip links hardware interrupt requests to the CPU. XTs have one PIC with links to recognize eight interrupt signals. AT-class and 386 machines have two PICs for a total of 16 links.

MEMORY-RELATED TERMS

Conventional memory Memory with addresses below 640K that temporarily

CONTINUES



FACT FILE

System Sleuth Analyzer, Version 2.2
Dariana Technology Group, 6945 Hermosa Circle, Buena Park, CA 90620; 714-994-7400.
List Price: \$79.95.
Requires: 256K RAM, DOS 2.0 or later.

In Short: *System Sleuth Analyzer* is the only reporting software that reports on I/O port addresses for expansion cards. Its other features are less-powerful than rival packages and its menus are confusing and awkward.



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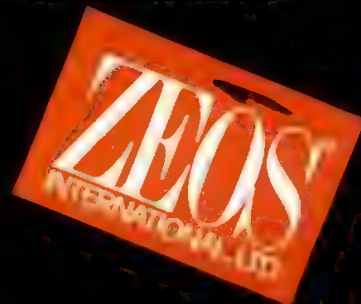
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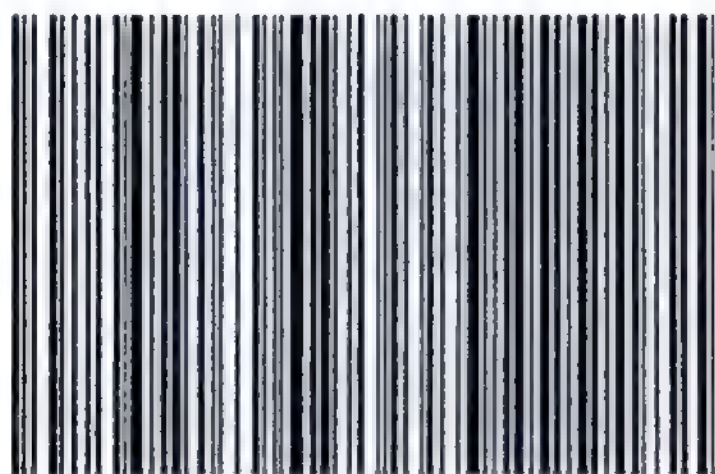
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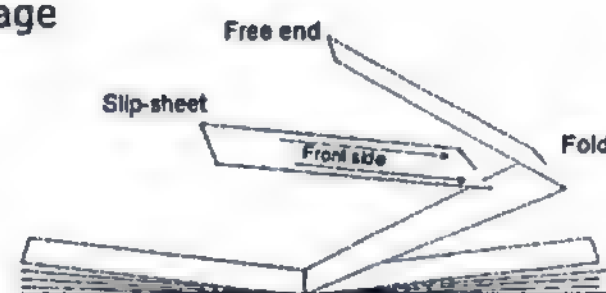
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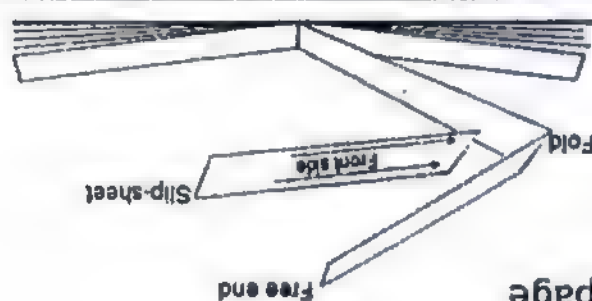
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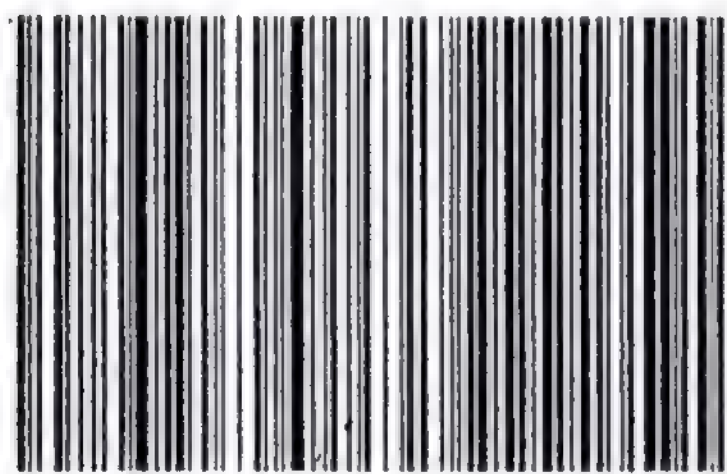


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 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlpBack-001B

Back

1. Follow instructions on the other side

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Reason #3

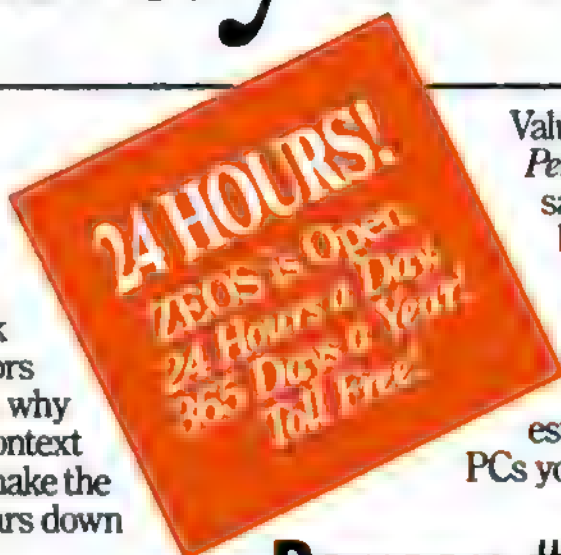
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Reason #8

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In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

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Defining Terms

CONTINUED

stores DOS, TSRs, drivers, and applications. DOS recognizes only 640K of RAM.

Expanded memory Memory (up to 32MB) assigned via the EMS specification (see EMS below). This memory is available on 8088/86 and 286 machines equipped with a memory board and interface software, and on 386 (or higher) machines that have an expanded memory manager such as Qualitas' *386MAX* or Quarterdeck's *QEMM-386*. The application software must also support the specification. This memory scheme lets you run more than one application simultaneously using operating environments like *DESQview* or *Microsoft Windows*.

Extended memory Memory with addresses between 1MB and 16MB on 286 machines and up to 4GB on 386 or 486 machines. This memory is accessible only when the processor is in protected mode. DOS runs applications in real mode and can utilize extended memory only indirectly through XMS. Also, some DOS applications include DOS extender utilities and can run in protected mode.

Himem area High memory area or HMA. This is the first 64K of memory above 1MB, accessible by the CPU in real mode and used directly by programs. Himem is accessible only on PCs with 80286 or higher processors and is controlled by Microsoft's HIMEM.SYS driver, Quarterdeck's QEXT.SYS driver, and i386 memory managers like *QEMM-386* and *386-MAX*. It is also, reportedly, accessed by MS-DOS 5.0.

Memory blocks Memory areas set aside by DOS for use by programs.

MCB Memory control block. DOS assigns a 16-byte descriptive header to each memory block to keep track of memory assignments. System setup software uses these MCBs to report memory usage.

UMB Upper memory block. A section of high-DOS memory—the 384K address space between 640K and 1MB—which isn't ROM or video RAM. You need LIM 4.0 to access this region and a memory manager such as *386MAX* or *QEMM-386* to place TSR programs and device drivers here, thus freeing space in 640K to run applications.

Video RAM Also called VRAM. The text/colors in text mode and pixels in graphics mode are stored in RAM on the video cards with addresses in a portion of high-DOS memory, the first 128K above the 640K conventional memory. VRAM contains instructions that convert digital signals to analog for screen display.

HARDWARE-RELATED TERMS

CMOS memory Complementary metal/oxide semiconductor. CMOS is a type of microprocessor circuitry that requires less power than a typical microprocessor and is used in some battery-powered laptops. The basic configuration information (BIOS) is stored on CMOS chips in 286, 386, and 486 systems.

DMA Direct Memory Access. For faster data transfer, hardware devices can use DMA to talk directly to memory without going through the CPU. DMA controllers use I/O channels or ports to perform housekeeping chores, such as moving blocks of memory from the hard disk into RAM. There is one Intel 8237A controller in an XT allowing 4 channels and 2 controllers with 8 channels in 286-based and higher machines.

I/O ports (processor) The CPU has 64K one-byte-wide input/output ports for sending data to and from external devices. The physical parallel, serial, and game ports on your system are different from these logical I/O ports.

SPECIFICATIONS

DPMI DOS/Protected Mode Interface. Introduced with *Microsoft Windows* 3.0, DPMI replaces the VCPI memory interface scheme (see below), and can access up to 16MB of memory on a 286 or 4GB on a 386/486.

EEMS Enhanced EMS specification. Originally proposed by AST, Ashton-Tate, and Quadram, it was largely subsumed by EMS 4.0 (see below).

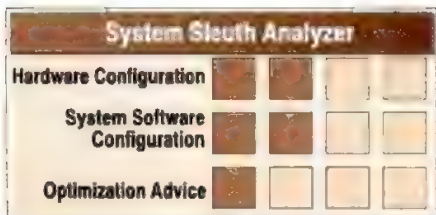
EMS Expanded Memory Specification. A standard for all PCs (including XTs) to organize and access memory outside the usual CPU address space of 640K for applications. EMS boards use the "wasted" space that is reserved for drivers to form windows called page frames. These page frames are located between 640K and 1MB, and the CPU can access it in four chunks of 16K. By moving this page frame around via program controls, the CPU can access all the physical memory on the board and "map" it into memory for applications use.

The first widely used version was EMS 3.2, followed by Version 4.0 in 1987, which also allows switching of addresses below 640K for multitasking. At the software level, an EMS driver controls program usage of EMS.

LIM Another name for EMS derived from the initials of Lotus, Intel, and Microsoft—the three companies that proposed the EMS specification. Most memory boards support LIM 3.2 and include software to handle LIM 4.0, the current EMS standard.

VCPI Virtual Control Program Interface. One of three schemes for accessing protected memory, VCPI (as well as XMS and DPMI) allows a memory manager or an operating system like *DESQview* 386 to run multiple protected-mode 386 programs, such as *Paradox* 386 or *Mathematica*, so they don't interfere with each other. While VCPI works only on 386/486 processors, 286 systems can run multiple DOS extended applications in protected mode via XMS service.

XMS Extended Memory Specification. A standard for accessing the Himem area and extended memory. Introduced with *Microsoft Windows* 2.1, it requires an XMS driver such as *Windows'* HIMEM.SYS or those found in the most recent versions of *386MAX* and *QEMM* (see Himem). ■



System Sleuth reads I/O addresses to see if a device is present, and in our workout, successfully reported that a device was located at every address used by hardware. It can't report which device is at any particular address, but at least it tells you that something is there and that you should install a new device somewhere else.

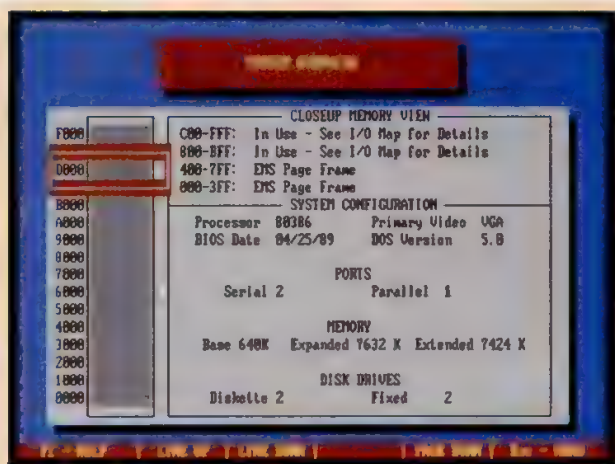
Technical support doesn't claim that its reports are infallible, and the program warns you that indiscriminate testing of I/O addresses can be dangerous. But some information is a lot better than no information. You can reduce the potential danger of fiddling with I/O addresses by rebooting immediately after performing this test, and you should definitely not

SYSTEM SETUP & REPORTING

whether the memory region is used by DOS, available for programs, or occupied by an EMS page frame or BIOS. If the contents of the region are too varied to be summarized on this small panel, the panel tells you to look at a more detailed listing available from a submenu.

The lower-right-hand panel on the opening screen offers a summary display of your computer's basic configuration—processor, serial ports, parallel ports, DOS version, and a few other details. If you obey the prompt to press PgDn for more, the three-part display is replaced by a screen with information from the CMOS setup, and another screen that tells you how the switches on your motherboard would look if you were using an IBM PC or XT. The help screen is not entirely clear in explaining that if you don't have a PC or XT, you probably don't have any motherboard switches at all.

Other information is displayed on the main menu, which you reach by pressing



System Sleuth Analyzer's opening screen includes a "slide-rule" memory map on the left side and memory-segment content information on the top of the screen. Although there is a mouse cursor visible next to the slide rule, you can't use it on this screen.

perform the test while connected to a network.

INTERFACE IN THE WAY

The program's other reporting is less ambitious than that of rival programs and has some notable limitations. When you first launch *System Sleuth* you see a complex three-part display in the middle of the screen with a title panel above and a menu line below.

In the left-hand section of the display you see a vertical scale that looks like a slide rule. As you move the "slide" with the arrow keys, a summary report on the contents of a memory region appears in the top right-hand panel. This tells you

Esc. Once you're in the menu, you can use only the arrow keys to move among options, and you'll probably overshoot the option you want. In complex systems, some of the information displayed scrolls so quickly that you can't read the screen.

Even when you can read all the information on-screen, you should treat it with caution. On one test system with some TSRs loaded into high memory by *QEMM*, *System Sleuth* reported the copyright of a TSR as if it were the copyright of the BIOS. It doesn't report the contents of EMS memory blocks, bus type, processor speed, or COM port parameters needed for advanced troubleshooting. Nor does the program report the presence of COM3,

COM4, or a game port. Although it reports on hardware interrupts, it failed to detect that IRQ5 was used by the Sound Blaster card on one of our test machines. In a two-monitor system, it reported the monochrome adapter's memory region as "EGA/VGA monitor memory" rather than MDA memory.

Dariana has recently reorganized its product line, adding a more sophisticated, more expensive package called *System Sleuth Pro* that was not available at the time of this evaluation, and put much of the functionality of *System Sleuth Analyzer* into *WinSleuth* (see evaluation below).

System Sleuth Analyzer comes with utilities that you won't find in rival packages, including a bare-bones 386 memory manager, a cache, and a backup program. But the only strong reason to consider using it is for reports on those elusive I/O ports, which no other program even attempts to examine.

WinSleuth

by Edward Mendelson

WinSleuth and *System Sleuth Analyzer* are products of the Dariana Technology Group, but you shouldn't assume that the two have very much in common. Unlike the DOS-based *System Sleuth Analyzer*, which probes awkwardly but deeply into the heart of your computer, Dariana's \$149 *WinSleuth* gracefully skims the surface.

YOUR WINDOWS SETUP

WinSleuth runs under *Microsoft Windows 3.0* and provides convenient information about your hardware and DOS environments. Its main value, however, is the ability to show you the capabilities of your *Windows* setup. *WinSleuth* will tell you the names of the various tasks running under *Windows*, the amount of RAM available to *Windows* and the way it has been allocated, the exact graphic and font capabilities of the printer and video drivers currently in use, and the network to



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CIRCLE 329 ON READER SERVICE CARD

which you may be attached.

Most of the detailed information you get from *WinSleuth* is fascinating in itself, but has no practical use because you can't change the capabilities of your printer or video drivers. The information that is useful to know, you can easily get from *Windows* itself. For example, the Help menu in Program Manager tells you whether you're running real, standard, or enhanced mode, and Control Panel and Windows Setup tell you which printer and video drivers are in use.

The reports you get on DOS and hardware from *WinSleuth* are useful, but detailed information is available only if you run *Windows* in real mode. *WinSleuth* tells you which TSRs were running when you started, but only when *Windows* is in real mode. It can tell you the vital statistics of your hard disks, but can only report the partition tables in real mode.

On a two-hard-disk system, where both ESDI drives are arbitrarily identified in Setup as Type 1, *WinSleuth* bizarrely reported that the second disk was Type 17. By twiddling the coprocessor equipment byte, we easily fooled *WinSleuth* into reporting that the test system has a 80387

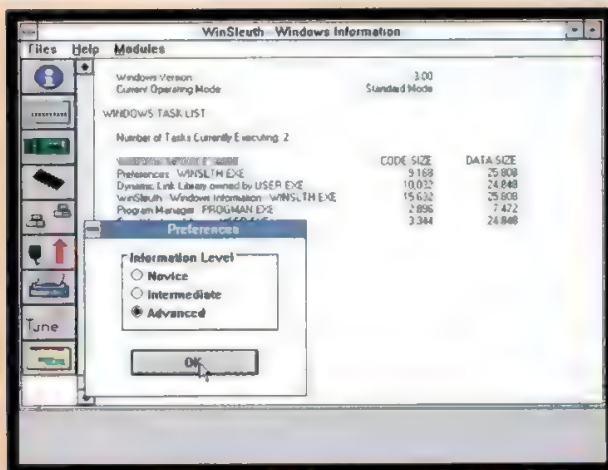
UTILITIES SYSTEM SETUP & REPORTING

chip that really isn't there. The program reports in a moderately detailed way on the contents of the upper memory region between 640K and 1MB but doesn't let you take a close look.

THREE REPORTING LEVELS

Although designed for use with *Windows*, *WinSleuth* doesn't take much advantage

of its graphics environment. You choose the screen you want to view by clicking on an icon in a bar on the left side of the screen. From the top-line menu you can choose novice, intermediate, or advanced reporting levels. If you choose the novice level, the hard disk reporting screen displays your partitions in the forms of bar graphs with the percentage of free space shown for each disk. The graph for a 1MB RAM disk is displayed at the same size of



WinSleuth lets you select the information you want from an icon bar. You can adjust the information displayed to novice, intermediate, or advanced levels.

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a 150MB hard disk, which gives a misleading image of disk capacity. If you choose the advanced level of reporting, all screens consist entirely of text.

One screen gives optimization suggestions—not all of them are accurate. If you use a disk cache other than SMARTDRV, *WinSleuth* isn't aware of it and simply tells you to install SMARTDRV—a dangerous suggestion if you install it without removing the existing cache.



FACT FILE

WinSleuth,
Version 1.0
Dariana Technology
Group, 6945
Hermosa Circle,
Buena Park, CA
90620; 714-994-
7400.

List Price: \$149.

Requires: 640K

RAM for real mode,
1MB RAM for standard mode, 2MB RAM for
386-enhanced mode, Microsoft Windows 3.0,
DOS 3.0 or later.

In Short: A system reporting package for
Windows that doesn't probe very deeply,
except in areas you can't do anything about
anyway. The next version will include much of
System Sleuth Analyzer's functionality as well.



CIRCLE 427 ON READER SERVICE CARD

One undeniably useful feature of *WinSleuth* is its file-viewing screens. Oddly, the manual gives you a list of viewer types "that may be available" in the program instead of a list of viewers that are actually there. The list in the manual includes viewers for *dBASE*, *Excel*, *WordPerfect*, *PC Paintbrush*, and *Windows Paint Bitmaps*. The only one of these that actually comes in the package is the viewer for *dBASE*.

WinSleuth can tell you a lot about your Windows printer and video drivers that no one but an advanced Windows programmer would know. Most of the other data that the program sleuths out of your system is available elsewhere for a lot less than *WinSleuth's* price of \$149. As part of Dariana's recent product line realignment, a version of *WinSleuth* that includes much of the functionality of *System Sleuth Analyzer* should now be available. Make sure that that's the one you get. ■

Edward Mendelson, Jim Seymour, and Barry Simon are contributing editors of PC Magazine.

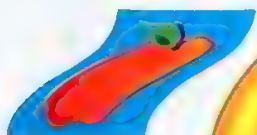
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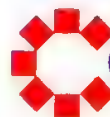
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Computer Monthly,
PC Brand 286/16,
Product Review

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Computer Buyer's Guide,
PC Brand 386SX-16,
Product Review

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PC Magazine,
PC Brand 386/25,
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InfoWorld,
PC Brand 386/33.
Product Review

386/25MHz and 386/33MHz Cached ISA Systems

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by
M. David Stone

Lab Notes

You say you like *Word for Windows* but you want more for your money? You'd like to use a different menu structure, a different set of speed keys, and different function keys? Or do you wish they'd added some menu choices that you consider crucial, or pared the menus down to avoid confusing the less-sophisticated users in your office?

If you answered yes to any of the above, the good news is that *Word for Windows*—or *Winword*, to call it by its shorter, command-line name—has enough customization capability to serve as a veritable word processor construction kit. If you want, you can virtually throw out the program interface as shipped and design a new one from scratch. (Note: *Winword* is not an official Microsoft designation for *Word for Windows*.)

This Lab Notes will help you work your way through some of the program's key customizing features. I'll cover not only the mechanics of macros, templates, and menu definition, but will also touch on more-global design issues as well. In short, you'll learn not only how to use these features, but when and why you might want to. All comments will apply specifically to *Word for Windows*, Versions 1.0 and 1.1. And since you'll be using the Microsoft documentation, the commands and key names will follow the standard *Winword* conventions.

The three central features that make *Word for Windows* so malleable are its BASIC-like macro language, its templates, and its ability to redefine the pull-down menus. Macro languages are nothing new, of course. Nor are templates; that is, files that serve as models for standard formats such as memos, letters, or manuscripts. But *Word for Windows* extends these features far beyond their implementation in other programs. And the ability to redefine pull-down menus is an enticing prospect for anyone who has always wanted to design his or her own interface.

Unfortunately, however, the Microsoft manuals cover these features only superfi-

Customizing Macros, Menus, and Templates In Word for Windows

■ Extraordinary flexibility exacts its price in the learning curve, but when you understand *Word for Windows*' macro language there's little you can't do with it.

cially. The *User's Reference* manual explains how to record, run, or edit a macro, and it shows you how to assign a macro or built-in command to a menu or key. But if you want so much as a list of macro commands, you must obtain the optional *Technical Reference* manual or print out its abridged version, the TECHREF.DOC file that comes with the program.

While you should certainly get the manual or print out the file, even these sources don't go much beyond giving the names and short descriptions of each command. Novice macro programmers will find painfully little information on why they might want to use any given command. Even experienced users, who know *what* they want to do, will be left guessing at *how* to do it, thanks to an almost total lack of proper syntax examples. And since you must discover the function of each command on your own, it's easy to overlook a key command, such as Rename-Menu, which lets you rename the top-level options in the pull-down menus.

TEMPLATES

If you've been using *Winword* at all, you've certainly noticed that every time

you open a new document file, you must attach a template. The default choice is the NORMAL.DOT template; indeed, you may never have bothered with anything else. If you ignore templates, however, you'll be missing one of *Word for Windows*'s key features. The template is the single most important concept for understanding and taking advantage of *Winword*'s customization capabilities.

In other word processors—from *WordStar* to *WordPerfect*—a template is usually no more than a model text file. A letter template, for example, may include boilerplate text (such as your return address), a marker showing the starting line for the date, and whatever formatting commands the word processor lets you store with the file. Depending on the program, you use the template either by copying it to another file and then loading the new file or by opening a blank file and reading the template in. In programs like *XyWrite*, which have sophisticated macro features, such templates are usually superfluous, since you can achieve the same result more efficiently with a macro that enters text and sets the format.

By pushing it to an extreme, however, *Word for Windows* has revived the usefulness of the template concept. As with traditional template files, a *Winword* template is essentially a document file. You can create a new template at any time or load and edit an existing template file just as you would any other document. *Word for Windows* recognizes the file as a template (and so is able to treat it somewhat differently from other documents) only because of the .DOT filename extension. Be-

Lab Notes

yond this, however, the differences between traditional and *Winword* templates begin to emerge.

One important difference is that when you use a *Winword* template, you don't have to copy it manually or read it into a new file. *Winword* does the equivalent of

copying the template for you whenever you open a new file. You simply pick which template to use from the File Open dialog box or accept the default NORMAL.DOT.

A far more important difference is that *Winword* lets you go much further in customizing a template. Not only can a *Winword* template include boilerplate text and formatting settings, but each template can include its own set of macros, its own set

of key assignments for those macros, and even its own set of menus.

Each *Word for Windows* template can also have its own set of *glossary entries* and *styles*. Glossary entries consist of boilerplate text and can thus be considered simply as text-only macros. Styles are one of the ways you can define a format. Specifically, styles let you use a single command to define both paragraph format and character format for one or more paragraphs. (DOS *Word* users will recognize this facility as a paragraph style. *Word for Windows* has no equivalent to character styles or division styles.) While styles offer some additional refinements, for purposes of this discussion, you can safely think of styles as special-purpose formatting macros.

Styles and glossary entries receive only passing mention here; they are not central to *Winword*'s customization capabilities. Although both are very much worth exploring, they are similar to macros in function. Neither can be directly assigned to a menu or speed key, though such assignments can be made by way of a standard macro.

Winword's extension of the template concept is as much an advance on using macros as the macros themselves are an improvement over doing everything manually. An example will help clarify this. If you create a letter template in *Word for Windows*, you can add a signature block macro to the Insert menu. This lets you end a letter simply by choosing Insert Signature Block. You can even create several variations on the signature block—using Sincerely, Sincerely Yours, Very Truly Yours, and so forth—each with its own separate menu entry. Since the macro and menu choice are both part of the letter template, however, they won't clutter the screen when you're working on something other than letters.

There are some features—notably boilerplate text and format settings—that you may want to read into a specific file once and not make part of the template in use, and *Winword* obviously permits this. However, the template's most important customization features—macros, key assignments, and menus—are not only made available to new files, but will be applied even to previously stored files that use those templates. You can also change the template (together with its associated customizations) assigned to a given file at any time. Simply choose Format Document (Alt,T,D) and pick a different template

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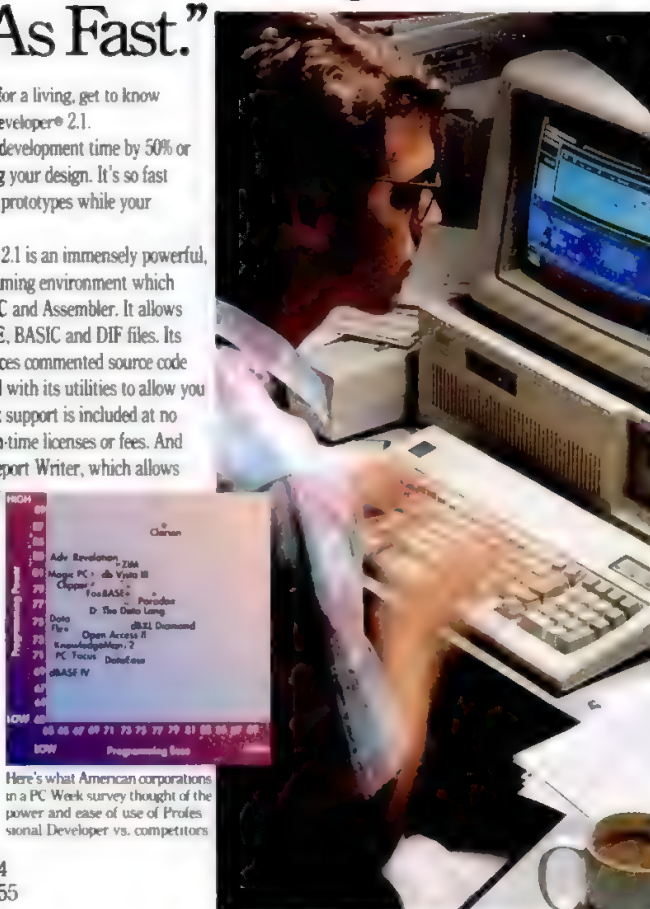
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Lab Notes

from the template list box.

Winword avoids the clumsiness of forcing you to load the template file every time you want to change one of its customizing features. To modify a menu, for example—a procedure that we'll cover in detail later—you simply make the modification on whatever file you happen to be using. If you designate that change as applying to the template, *Winword* will modify the template itself, and the change will show up in all files that use the template.

I'll have more to say about templates later in connection with overall design issues. However, it will be helpful to look first at some of the specifics involved in creating macros, assigning keys, and modifying *Winword's* menu structure.

MACRO BASICS

Macros in general fall into two groups: keyboard macros and programmed macros. Keyboard macros store keystrokes or their equivalent mouse clicks and then play them back just as if you were typing at the keyboard. A keyboard macro for opening a file in *Word for Windows*, for example, might be

```
{Alt}FO*.*{Enter}{Tab}{Down}
```

This macro chooses the File Open command, enters the wildcard characters to search for any filename (rather than searching for the default *.DOC), tabs to the list of files so that you can select which one to open, and then enters one Down Arrow keystroke to highlight the first choice on the list.

Programmed macros may also include keystrokes that you could have typed on the keyboard, but the essence of a programmed macro is that it incorporates programming logic. For example, before issuing the File Open command, a programmed macro might stop and ask you whether to list all files or just those with a .DOC extension. Depending on your answer, the programmed macro would then branch to one or another section of the macro and enter the appropriate keystrokes.

The keyboard macro feature of most of today's full-function word processors (*WordPerfect* and DOS *Word*, for example) allows inclusion of a number of macro commands. In some cases, the macro

command set can even approach the flexibility of a true programming language.

Macros in *Word for Windows* are radically different from those found in other word processors. For one thing, there is no keyboard macro feature as such. That is, the macros do not simply send the same keystrokes to the program that you could type at the keyboard. And for another thing, the *Winword* macro language does not just approach the flexibility of a programming language; it is a programming language. WordBASIC is a modified subset of BASIC, one in which additional commands have been included to take advantage of *Winword's* built-in features. The macro command to open a file, for example, is FileOpen, not the keystrokes Alt,F,O. While it is possible to send these keystrokes to the program from a macro, the *Word for Windows* approach is neither

Macros in *Word for Windows* are radically different from those in other word processors.

obvious nor straightforward.

To see the difference, let's assume you want to write a macro that will give the File Open command, enter the *.* wildcard characters, and show you a list of files from which to choose. Since *Winword* has a macro learn mode, your first thought would probably be to use it to create the macro.

To enter the learn mode, you enter the Macro Record command (Alt,M,C). You could accept the default macro name or type a new one in the dialog box, optionally enter a macro description, and then designate the macro as either a global or a template macro. (A *global* macro applies to all documents, whereas a *template* macro applies only to those files that use the current template as their model.) You then choose OK, and in this case, you type

```
{Alt}FO*.*{Enter}{Tab}{Down}
```

At this point, you choose Macro Stop Record (Alt,M,C) to end the macro. If you try this, however, you'll find that *Winword* won't let you use the Macro Stop Record

command from within the dialog box. You can choose OK to load a file or Cancel to leave the dialog box without loading a file. With the macro learn feature of most word processors, either choice would at least work. In the DOS version of *Word*, for example, you could either load the file or not, stop the macro recorder, and then edit the macro to delete the final step. Unfortunately, this won't work in *Word for Windows*.

Why not? Ironically, the problem arises because the learn feature in *Word for Windows* is far more sophisticated than that found in other programs. Rather than record your keystrokes one by one, the *Winword* learn mode records the final result. So if you choose Cancel in the dialog box, the learned macro is essentially blank. And if you choose OK, the learned macro will always automatically load the same file.

If you try creating this macro both ways, you can see the results in each case by editing the macro you've just recorded. Choose Macro Edit (Alt,M,E), then pick the appropriate macro from the names in the list box, and choose OK. If you edit the version that you ended by canceling the command, the macro will contain just two lines:

```
Sub MAIN  
End Sub
```

These two lines are the beginning and end markers for the macro's MAIN subroutine. (One of the rules for creating a *Word for Windows* macro is that the main program has to be written as a subroutine called MAIN. Leave out these two lines when you write a macro, and the only response you'll get when you run it is "syntax error.") The absence of any text between these two markers means that you haven't recorded any commands.

If you edit the version that you ended by loading the file WHATEVER.DOC, the macro will have three lines

```
Sub MAIN  
FileOpen .Name = "whatever.doc",  
  .ReadOnly =  
End Sub
```

The line that counts here is the one that includes the FileOpen command. Note that the macro will have exactly the same commands whether you typed the filename or picked it from the list box. And it will also remain the same even if you included some extra keystrokes while searching through the list box for the filename.

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The point here is that the recorded macro depends only on the final result, not on the keystrokes you used to get there. In our example, this translates (roughly) into "Open the file *WHATEVER.DOC* and don't make it read-only." *Winword*'s learn mode will ignore any extraneous commands that you type. This means that if the file you load is in a different directory, you'll also find a *ChDir* command in the macro along with the full path of the directory. However, if you change the directory, return to the one you started from and then load the file, you won't find the *ChDir* command.

Microsoft's decision to record macros as absolute commands rather than as keystrokes has at least three advantages. First, it leaves Microsoft free to change the menu structure and dialog box structure in future versions of *Word for Windows* without forcing users to rewrite their macros. Any macro written with absolute commands will work regardless of program structure, as long as the underlying commands remain the same.

Second, but for the same reason, this approach frees you to modify the menu structure and key assignments as needed. Here again, you won't have to rewrite your macros just because you've changed a menu entry or key assignment. And a third, related benefit is that the same set of macros will work in all your templates, even if you've completely redesigned the menus in some templates.

The chief disadvantage of this approach is that you have to understand the macro language in order to write even the simplest macro that includes commands. In those cases where the learn mode doesn't work—that is, for all nontext macros—it's not enough to know the right keystrokes for the function that you want.

One way around this limitation might seem to be provided by WordBASIC's *SendKeys* command. As the name implies, the *SendKeys* command lets you send specific keystrokes to the program. This will produce the same result as would a conventional keyboard macro feature. However, since you can't create a macro in learn mode that uses the *SendKeys* command, you'll have to write the *SendKeys* macro in the macro language.

To create a macro from scratch, then, you enter Macro Edit (Alt,M,E), type in

an appropriate name such as *FileChoice*, and choose OK. *Winword* then takes you to the macro edit screen, automatically enters the *Sub MAIN* and *End Sub* statements, and leaves you with the cursor on a blank line between the two markers. For our general-purpose *FileChoice* macro, you would edit the macro to read as follows:

```
Sub MAIN
SendKeys  "%FO.{enter}{tab}{down}"
End Sub
```

The percent sign is interpreted as the Alt key. To enter a Ctrl-F instead of an Alt-F, you would use ^F, and for an uppercase F you could enter either F or +f. Note that you can apply the % (percent), ^ (caret), or + (plus) to more than one key by using pa-

**You won't have to
rewrite your macros
just because you've
changed a menu entry
or key assignment.**

rentheses: +ffff will be sent to the program as Ffff, while +(ffff) will be sent as FFFF. Note also that you must type in the {enter}, {tab}, and {down} keys as text, complete with brackets. The rest of the line is self-explanatory, consisting of the keystrokes you would type to enter the command manually.

After you've entered the macro command, you can test it by choosing Start from the macro menu bar. If you've typed everything in correctly, you should be rewarded with the File Open dialog box on the screen. The list box should show all files in the current directory, with the first file highlighted. Once satisfied that the macro works, you can close the macro edit window. *Winword* will ask whether you want to keep the changes. Be aware that answering yes does not save the changes to disk. *To save the macro for future use, choose File Save All.*

You might note in passing that to test a longer macro, you're generally best advised to use the Step command from the macro menu bar. Each time you give the

Step command, *Winword* runs one step in the macro. Thus, if you arrange the screen so that you can see the macro in one window and a document file in another, you can watch the highlight move through the macro and see the effect that each step has on your document. That way, if something doesn't work as you expected it to, you'll know exactly where the problem is.

Unfortunately, however, using the *SendKeys* approach to create what amounts to a keyboard macro defeats the whole purpose of using absolute commands in the first place. The only time it's completely safe to use this approach is as a quick-and-dirty solution for a temporary macro. After all, if you're not keeping the macro for long, then it doesn't matter if you change a menu command or key assignment at some later point. Almost as safe is using *SendKeys* for menu commands that you're convinced you'll never change. For example, the odds are pretty high that you won't change the File Open choice—unless you decide to redesign the menus altogether.

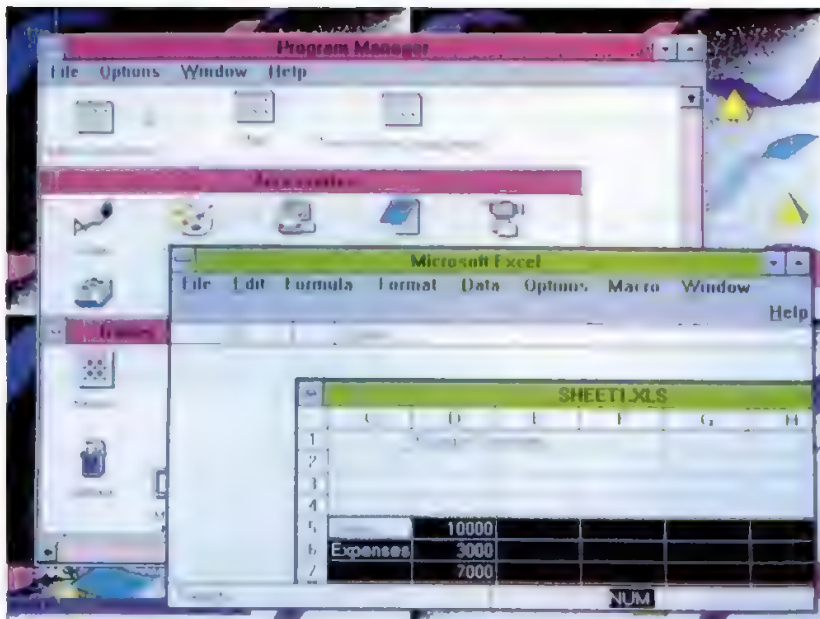
Fortunately, there is little if anything that you can do with *SendKeys* that you can't do with the other, preferred WordBASIC commands. The more elegant approach is to call up the dialog box and set the variables the way you want them. Learning how to work with dialog boxes is an important technique in WordBASIC, since dialog boxes are central to *Windows* applications.

To use the more elegant method, you would choose Macro Edit, enter a macro name, and enter the following statements between the *Sub MAIN* and *Sub End* markers:

```
Dim DRecord As FileOpen
GetCurValues DRecord
DRecord.Name = "*. *"
Dialog DRecord
Super FileOpen DRecord
```

The first line in this macro uses the *Dim* statement to create a dialog record named *DRecord*. It also creates and assigns a set of empty fields to *DRecord* to match the fields in the FileOpen dialog box. Of particular interest, for our purposes, is the name field, which we want set to *. *.

The *GetCurValues* statement gets the default values for the FileOpen dialog box and stores those values in the appropriate *DRecord* fields. The third line sets the Name field in *DRecord* to *. *, after which the *Dialog* statement in the fourth line



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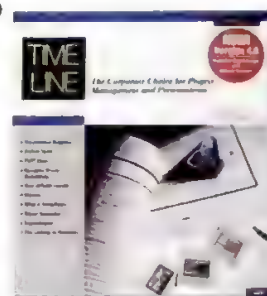
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Lab Notes

opens the dialog box, using the current values stored in DRecord.

At this point in running the macro, you would interact with the dialog box to select a file. Finally, the last line runs the program's built-in FileOpen command (as distinguished from any FileOpen macro that you may have written), using whatever choices you made in the dialog box.

According to the *Technical Reference* manual, the prefix Super in the last line is needed to tell *Winword* to use the built-in version of the FileOpen statement instead of calling a macro of the same name. However, it turns out that *Winword* consistently calls on the built-in statement in any case—with or without the Super prefix. (Microsoft confirms that the manual is in error and that the Super prefix actually does nothing.) Contrary to the manual, the only time you need an additional command is when you want to run a macro instead of the built-in statement. The command to run a macro is MacroRun, which takes the form

```
MacroRun .Name = "Whatever"
```

where *Whatever* is the name of the macro to run. Note the period before Name; it's an important part of the syntax.

If you enter and run this macro, you'll find that unlike the version that uses the SendKeys statement, this one does not automatically go to the files list in the dialog box. However, you can add that feature easily enough with this line:

```
SendKeys "{tab}{down}"
```

This statement should go before the Dialog DRecord line. Be warned that if you try to run this with the macro Step feature, the program will send the {tab} and {down} keys to the current screen rather than the dialog box. However, if you run the macro normally, it will work properly. Note, too, that using the SendKeys statement in this context is not likely to cause a future problem, since it's unlikely that you'll ever change the built-in dialog box.

Finally, there is at least one other feature you'll probably want to add to our sample macro. If you run it as shown and you choose Cancel to exit without loading a file, *Winword* will respond with an error message when it tries to run the last line of

EXPANDING WINWORD'S FILEOPEN COMMAND

COMPLETE LISTING

```
Sub MAIN
REM: Create a dialog record, called DRecord
REM: With fields to match those in the FileOpen Dialog Box
Dim DRecord As FileOpen
REM: Now get the default values for those fields
GetCurValues DRecord
REM: Set DRecord to look for all files
DRecord.Name = "*. *"
REM: Highlight the first file in the list box
SendKeys "{tab}{down}"
REM: If there is an error, jump to the last line
On Error Goto Skip
REM: And display the Dialog record
Dialog DRecord
REM: Open the chosen file.
Super FileOpen DRecord
REM: The place to jump to in case of an error
Skip: End Sub
```



Figure 1: This macro for opening a file differs from *Winword*'s built-in FileOpen command in that it will list all files in the current directory, not just those ending in .DOC. It also demonstrates how to feed information into a dialog box and how to display that box on-screen as part of the macro.

the macro—the line that includes the actual command to open a file. You can get around the problem, quite literally, by adding a command to skip the error message.

WordBASIC lets you handle errors through its On Error control structure. On Error takes one of three forms: (1) On Error Goto 0; (2) On Error Resume Next; and (3) On Error Goto LABEL. The first form, On Error Goto 0, displays the error messages and is the program default. In a macro, you'll use it only after you've used one of the other two formats for a particular section of the macro and want the error messages turned back on.

The second option, On Error Resume Next, tells WordBASIC to ignore the errors and continue the macro. The third choice lets you control program flow based on the error. In our sample macro, you can use it to tell WordBASIC to skip to the end of the file if it gets an error message, by entering the line

```
On Error Goto Skip
```

You could put this line at any point before the Dialog DRecord line, but it's good practice to place the On Error command just before you want it to come into play. That way you don't inadvertently trigger the jump in response to some other error. In this case, that means placing the line immediately before the Dialog DRecord line.

You'll also now need to add the label SKIP so that WordBASIC will know where to jump. In this case, you want it to jump to the end of the macro. Note that WordBASIC will recognize a label only if

it is followed by a colon and a statement on the same line. To tell *Winword* to jump to the end, put the Skip label on the same line as End Sub:

```
Skip: End Sub
```

Note also that WordBASIC will recognize labels only if they start in the first position of the line. Thus, if you are writing a complicated macro that has some lines indented for readability, be sure *not* to indent the lines with labels.

Figure 1 contains the full macro discussed above, and in Figure 2 you'll find a macro that will help you document both your own macros and the sample macros Microsoft supplies with *Winword*. Briefly, the macro in Figure 2 reads all of the macros currently available, copies the text to a document file, and adds labels that include the macro name. You can then print the document; this gives you a printed set of examples for creating your own macros. The set of 10 macros shown in Figure 3 will delight not only old *WordStar* aficionados but also touch-typists who find *Winword* less than keyboard-friendly.

The comments above are only the barest introduction to the WordBASIC language. However, the combination of the examples presented here, together with those in the *Technical Reference* manual should be enough to get you started.

It's encouraging to note that Microsoft is aware of the limitations in its manuals and is developing what it calls "additional tools." Among these is a very thorough macro training guide, called *Using WordBASIC*, written by WexTech Systems. For

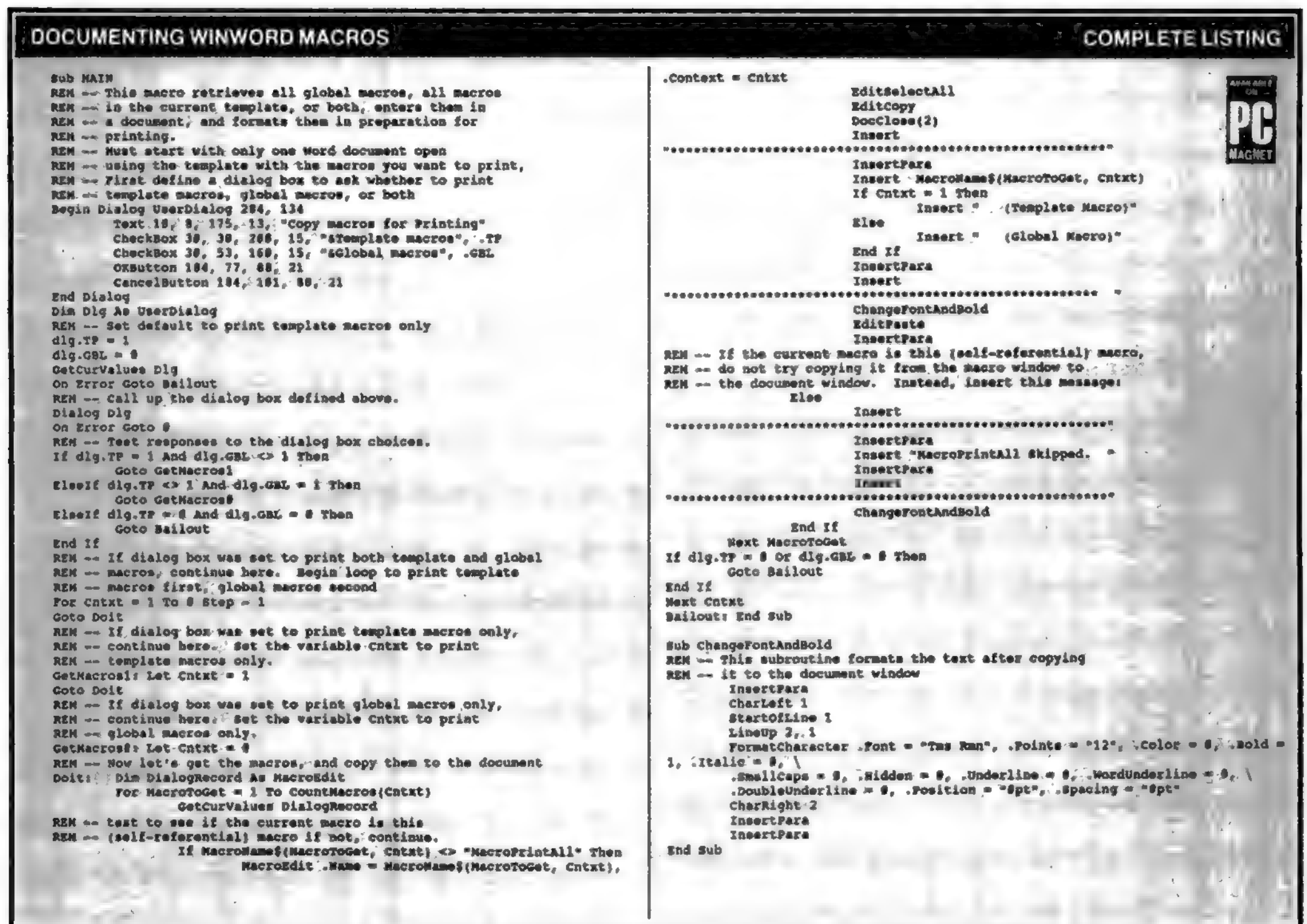


Figure 2: This heavily commented *Winword* macro will help you document both your own macros and those supplied with the program.

beginners, the manual includes a tutorial in simple BASIC programming; it also provides plenty of examples. Even if you don't need the tutorial, the guide is worth getting, as a reference to the proper syntax for the various macro commands.

Unfortunately, as of this writing, *Using WordBASIC* is not yet available. Microsoft was kind enough to provide a set of unbound galley pages as background for this article, but the company has not yet decided whether the guide will be sold separately or will be included with *Word for Windows* in the future. In any case, if you're interested in customizing *Winword*, keep an eye out for the manual. It's well worth having, and may even be available by the time you read this.

Microsoft may offer still other supplementary tools. Until it does, however, you'll have to make use of the ones you can find. One invaluable source of information is the *Word for Windows* forum in

the Microsoft section on CompuServe. To get there, type GO MSAPPS at the CompuServe prompt. You'll find the *Word for Windows* Forum in section 12 of the MSAPPS Forum.

ASSIGNING KEYS

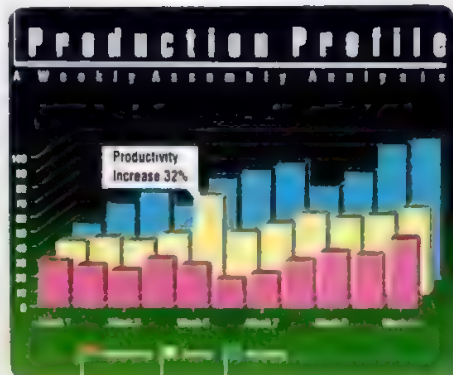
In most respects, *Word for Windows* does not sharply distinguish between its built-in commands and user-defined macros. There are some differences, of course: if you go to the Macro Edit dialog box, for example, you'll find that *Winword* will not let you delete any of the built-in choices. On the other hand, it will let you edit them, it will let you assign them to your choice of shortcut keys, and it will let you add or remove the commands from menus or move them to different menus. In general, then, the program's native commands and the macros that you have created are on exactly the same footing.

In the following examples, we'll sam-

ple all of these features. *Before you try any of them, however, be sure to copy your original NORMAL.DOT file to another name, such as NORMAL.OLD.* It's obviously a good idea to create a backup copy of your template files before you begin to experiment with modifications. But note that it's also important to make backups *after* you've made modifications to a given template, just as you would for any file that represents an investment of time.

To see how easy it is to change keystroke assignments, start *Word for Windows* and choose File New to create a file using the NORMAL.DOT template. If you haven't previously customized your keys, you'll find that *Winword's* Bold command is assigned to Ctrl-B. To confirm this, choose Macro Assign to Key (Alt,M,K), and highlight the macro named Bold. If the key hasn't been reassigned to some other macro, the entry in the Current Keys box will read Ctrl+B. (If

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TEN BASIC WINWORD MACROS

For PC users (like me) who don't like taking their hands off the typing keys, here are six macros that let you move the cursor without moving your hands. Using E, X, S, and D as four points of the compass, assign ArrowLeft to ^S, ArrowRight to ^D, ArrowUp to ^X, and ArrowDown to ^M. Extending that geographic mnemonic slightly, assign WordLeft to ^A and WordRight to ^F.

```
.....
ArrowLeft
.....
Sub MAIN
CharLeft 1
End Sub
```

```
.....
ArrowRight
.....
Sub MAIN
CharRight 1
End Sub
```

```
.....
ArrowUp
.....
```

```
Press RETURN for more; type NO to stop:
Sub MAIN
LineUp 1
End Sub
```

```
.....
ArrowDown
.....
Sub MAIN
LineDown 1
End Sub
```

```
.....
WordLeft
.....
Sub MAIN
WordLeft 1
End Sub
```

```
.....
WordRight
.....
```

```
Press RETURN for more; type NO to stop:
Sub MAIN
WordRight 1
End Sub
```

Following are three deletion macros: for character, word, and line. Assign them to the control-key combination of your choice, and they will let you perform the most common deletions without taking your hands from the typing keys. A good set of mnemonics would be ^C for delete character, ^W for delete word, and ^L for delete Line.

```
.....
DeleteCharacter
.....
Sub MAIN
CharRight 1, 1
EditClear
End Sub
```

```
.....
DeleteWord
.....
Press RETURN for more; type NO to stop:
.....
Sub MAIN
WordRight 1, 1
EditCut
End Sub
```

```
.....
DeleteLine
.....
Sub MAIN
StartOfLine
EndOfLine 1
EditCut
End Sub
```

Finally, here's a macro that will take you to the file open dialog box and list the files available in any given directory -- in this example, the DATA directory on C. If you keep your files in several directories, you'll find this extremely useful for moving among your directories.

```
Press RETURN for more; type NO to stop:
Data
.....
Sub MAIN
Dim DRecord As FileOpen
GetCurValues DRecord
DRecord.Name = "C:\DATA\*.*"
SendKeys "{enter}{tab}{down}"
On Error Goto Skip
Dialog DRecord
Super FileOpen DRecord
Skip: End Sub
```



Figure 3: These ten macros show how even an apparently trivial macro can add tremendous convenience to *Word for Windows*. Old hands at word processing will recognize the first six macros as incorporating the famous "WordStar diamond." Touch-typists will find that they make the *Windows* environment much more pleasant to use, because they let you move the cursor without having to take your hands off the keyboard. The three deletion macros will also let touch-typists leave their hands on the keyboard more often. The last macro is somewhat longer, but it's basic enough to be useful to virtually everyone. Using it as a model, create a macro for each of your data directories and name each macro after the directory it takes you to. You can then move to any data directory by running the macro that shares the same name.

this key has been reassigned, the Current Keys box may be empty or may show one or more alternative entries.)

There are several points to notice here. First, as indicated previously, when assigning keys, *Winword* makes no distinction at all between its own built-in commands and user-defined macros. Second, a single macro (or built-in command) may be assigned simultaneously to as many keys as you wish. For example, with Bold still highlighted, type Ctrl-Q. Unless you've assigned that key elsewhere, the box labeled Key should now show

Ctrl+Q
(Currently Unassigned)

Next, choose Assign (Alt-A). The Current Keys box will now be

Ctrl+Q
Ctrl+B

Select OK to return to the document, type in some text, and highlight a selection. Now you can toggle boldface on and off with either Ctrl-Q or Ctrl-B.

A third point that is worth noting here is

that you can easily reassign a key to a completely different macro. With Ctrl-Q still assigned to Bold, highlight any other macro and type Ctrl-Q. The box labeled Keys will now contain

Ctrl+Q
Bold

To change the assignment, simply choose Assign (Alt-A), and Ctrl-Q will be reassigned to the currently highlighted macro. If you don't like Microsoft's choice of control-key combinations, reassigning the

Lab Notes

keys is just that easy. You can assign Ctrl-Shift key combinations and most of the function keys—by themselves or in combination with Control, Shift, or Ctrl-Shift—in the same easy manner as just used for Ctrl-key combinations. You should take note, however, that *Winword* will not let you assign any macros to Alt-key combinations.

ASSIGNING MENU COMMANDS

Assigning macros and commands to menus is similar to assigning keys. For example, suppose you wanted to move the Glossary option from the Edit menu to the Macro menu. You'd begin by choosing Macro Assign to Menu (Alt,M,M) and highlighting the &Edit choice in the Menu list box to indicate the menu from which you want to remove a macro. Next, move to the Menu Text list box and highlight the Gl&ossary choice. Note that entries in the Menu list box use an ampersand (&) to indicate the keystroke that invokes the particular option. The selection key, which will be underlined on the menu, is the one immediately following the ampersand.

With the Gl&ossary choice highlighted, *Winword* will automatically highlight the currently attached macro name in the Assign Macro Name box. In this case, the name is EditGlossary. At this point, you could remove the Glossary choice from the Edit menu simply by choosing the Unassign button, but for the moment let's delay that step.

Move to the Menu list box and highlight the menu name you want to move to: &Macro. Notice that the Glossary choice is still showing in the Menu Text box even though the list box underneath shows the current choices for the Macro menu. At this point, you can change the name for the Glossary choice by typing any name you wish. Since there is no other choice on the Macro menu that starts with a G, change the entry to &Glossary.

(Note, at this point, that two items can be designated by the same &-letter on the same menu. You could, for example, redefine the two save choices on the File menu as &Save and &Save As. If you do this, however, you will lose the ability to identify either choice uniquely with a single letter. Moreover, instead of running the command when you type the duplicated letter, *Winword* will simply shift the

highlight from one command to the other. To run the currently highlighted command, it will be necessary for you to hit Enter. It's usually sensible to avoid using the same selection letter for two items on the same menu.)

Returning to our menu-changing example, if you look at the pull-down menus, you'll find that at this point the Glossary choice is now on both the Edit menu (with the O underlined) and on the Macro menu (with the G underlined). If you like, you can leave the entry in both places. Alternatively, you can remove it from either or both menus. Simply choose Macro Assign to Menu, highlight the menu you want to remove it from, highlight the name Glossary, and choose Unassign.

Again, as with key assignments, *Winword* makes no distinction between assigning its built-in macros to menus and assigning user-defined macros. In fact, the same few steps let you move any of *Winword's* commands to any menu, add any macro that you've created to any menu, change the names of the menu options, or change the selection key for any given menu choice. In short, you can redesign the menus as quickly and easily as you can assign macros to control-key combinations.

The only menu choices you *can't* manage from the Macro Menu dialog box are the first-level menus. Even this level can be customized easily by using the RenameMenu command. For example, if you are a longtime user of the DOS version of *Word*, you might prefer using T (for Transfer) to get at the file and print commands rather than *Winword's* F (for File). And you might prefer using F for Format, rather than T.

The macro that does this is trivial:

```
Sub MAIN
RenameMenu 0, "&Transfer"
RenameMenu 4, "&Format"
End Sub
```

Note the number after each RenameMenu command. This tells WordBASIC which of the menu *positions* you want to rename.

As shipped, position 0 is the File menu, 1 is the Edit menu, 2 is View, 3 is Insert, 4 is Format, 5 is Utilities, 6 is Transfer, and 7 is Window. The only position that can't be renamed is Position 8, the Help menu.

If you save this macro as AutoExec, making sure to choose Global for its context, it will automatically reset the menus every time you start *Word for Windows*.

Note that the program offers a total of five automatic macros. The other four are AutoNew, which runs whenever you open a new file; AutoOpen, which runs whenever you open a document; AutoClose, which runs whenever you close a document; and AutoExit, which runs when you quit *Winword*.

The eight slots available for first-level menus are enough to let you re-create the *WordPerfect 5.1* pull-down menus or the venerable *WordStar* menus. You can even go *WordStar* one better by creating menus that include the actual *WordStar* mnemonics, such as Quick Alter text for QA rather than *WordStar's* Quick Replace. Ironically, by limiting the program to eight first-level menus, Microsoft has made it impossible to duplicate the menus from *Word*, Version 5.0. This latter requires 15 first-level menus in addition to Help.

MORE ON TEMPLATES

Having now taken the grand tour of macros, menus, and key assignments, it's time to return to the subject of templates and clear up a possible source of confusion. As mentioned earlier, when you create a macro or other customization in *Word for Windows*, you must designate a *context* for that customization. The *Winword* manual and program refer to the choices as *global context* and *template context*. A global macro works no matter where you are in the program, whereas a template macro works only when you are using the template it applies to.

This way of describing the alternative contexts is somewhat misleading. The simple fact is that *all* macros, key assignments, and menu assignments are stored as part of a template. Customizations designated with the so-called global context are simply stored in NORMAL.DOT.

Moreover, all *Winword* documents use the NORMAL.DOT template, either by itself or in addition to a second template. Customizations assigned to the template context are stored in the template that *Winword* acknowledges as currently attached. In short, a better description of the context choice is *NORMAL.DOT template* versus *current secondary template*.

The complete equivalence between NORMAL.DOT and *global context* explains why *Word for Windows* permits only the global context choice for a document that uses the default template. It also explains why if you erase or rename NORMAL.DOT, *Winword* will create a new NORMAL.DOT the first time you assign

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Lab Notes

anything to a global context. Most importantly, it helps clarify how the templates work and makes it easier to understand how to organize your macros and other custom features.

LEVELS OF OPERATION

Word for Windows recognizes three command levels: built-in commands, which include both WordBASIC statements such as FileOpen and the built-in macro of the same name; the customized commands in NORMAL.DOT; and the customized commands in the current secondary template. Each command layer takes precedence over the one before.

For example, *Word for Windows*' built-in Bold command, which is assigned to Ctrl-B, toggles currently selected text between bold and normal modes. If you create a global macro for NORMAL.DOT called Bold, when you type Ctrl-B, *Winword* will run the macro you defined, not the built-in command that ships with the program. And if you create still another macro called Bold and make this a part of a secondary template, when you type Ctrl-B while using *that* template, *Winword* will run the version stored as part of the secondary template.

Something similar happens with key assignments. Suppose, for example, that you leave Ctrl-B assigned to the Bold macro in NORMAL.DOT, but assign it to some other macro in a particular template. The other macro might be called BoldCenter and might format for bold and centering at the same time. In this case, when you are using the NORMAL template and type Ctrl-B, you'll toggle between bold and normal text. But when you're using the particular template, Ctrl-B will run the BoldCenter macro instead. Menu assignments show these same levels of precedence.

Clearly, there is ample opportunity for confusion if you assign the same macro name or same keystroke to different functions in different templates. Menu assignments are less of an issue, since you can read the menu choices from the screen. Even with menus, however, if you have too many differences from one template to the next, you may feel an incongruity, as if you were working in two different programs.

The lesson here is to use restraint, even

while taking advantage of *Winword*'s flexibility. In essence, you want to pick an overall design for menus and control-key logic and stick to it, varying only those features that will not cause confusion.

For example, if you generally prefer to see all filenames rather than .DOC files only, you will probably want to overlay the built-in FileOpen macro in NORMAL.DOT with the example discussed earlier. However, you might want modified versions attached to the menus in secondary templates, so that a letter template would default to listing *.LET files and a memo template to *.MEM.

Microsoft ships *Winword* with several templates in addition to NORMAL.DOT. Among these are various choices for memos, letters, articles, and legal briefs. If you haven't looked at any of these closely, you definitely should. The Sampler manual that comes packaged with *Winword* (subtitled "Example Documents and Templates") discusses how to use each template. More important, it lists the macros for each, the menu options added to each,

The real point of
Winword's flexibility is
to match the program
to the way you work.

and the menu options removed from each.

Before undertaking your own modifications, it's instructive to consider the logic behind Microsoft's own choices. The LETTER.DOT template, for example, eliminates about 25 options from the menus. Some of these commands are obviously irrelevant when writing letters. Since you wouldn't use footnotes, outlines, an index, or a table of contents in a letter, the Microsoft letter template eliminates the Footnote, Index Entry, Index, and Table of Contents entries from the Insert menu, along with the Outline and Footnotes entries on the View menu. Similarly, you aren't likely to include graphics, so the template drops the Picture option from the Insert menu.

Other missing options are more arguable, and depending on how you work, the odds are that you'll disagree with at least some of Microsoft's choices. For exam-

ple, the letter template eliminates the Search, Replace, and Go To commands from the Edit menu, along with the Bookmark command from the Insert menu and the Compare Versions and Sort commands from the Utilities menu. The logic behind these decisions seems to be that letters are short enough that such features are not important. But I'd argue that *all* these choices belong on the menus, even in a letter template, partly because letters can be several pages long and partly because the features can be useful even in a one-page letter.

Even more interesting are the choices of commands added to the standard menus. Most of these involve very specialized macros. For example, on the Insert menu for the letter template, you'll find a command to Insert Closing and a toggle between Insert Letterhead (complete with return address and logo) and Insert Letterhead Space (which inserts a 2-inch blank top margin for use with printed letterhead stock). Some added choices are of interest for other kinds of writing as well. For example, both the letter and memo templates offer choices on the Format menu for setting the margins to 1, 1.25, and 1.5 inches.

The design rule I recommend is that if a macro is of interest for one or two kinds of writing, include that macro only on the appropriate templates. Within those templates, be consistent and try to define logical groupings. Identical or equivalent macros should go on the same menu in each template, should use the same name, and (as far as possible) should be presented in the same order.

As with the comments on the macros themselves, these suggestions on menu design barely qualify as an introduction to the subject. Many software companies have already demonstrated how easy it is to design a confusing combination of menus and shortcut keys. It's well worth it to plan your templates rather than add to them haphazardly.

Finally, remember that the real point of *Winword*'s flexibility is to match the program more closely to the way you work. This means that you may even wish to design different templates for different users in the same office. With *Word for Windows*, the limitation is not the program, but rather your own ability to envision what the ideal word processor for you should look like. ■

M. David Stone is a contributing editor of PC Magazine.

The Windows Experts

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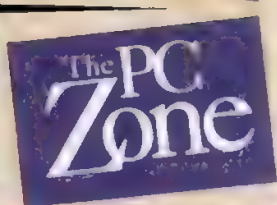
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by
Marc Adler

Utilities

PC users have been fascinated with icons since the day *Microsoft Windows 3.0* arrived. Whole collections of user-defined icons can now be downloaded from electronic bulletin boards and on-line services (including PC MagNet), and ads for commercial icon packages have already begun to appear in national magazines. But what do you do if you want to create your own?

The powerful Paintbrush program that comes with *Windows 3.0* lets you create bitmaps but not icons. A bitmap is simply a series of bits that represent the image on the screen. *Windows* icon and cursor files contain small bitmaps, but they also include header information. The creators of Paintbrush could easily have added icon editing capabilities to their program by providing a way to attach this header information to a bitmap. Unfortunately, they have not yet done so.

Until now, therefore, the only way to create a new icon has been to use the SDKPaint program that comes with the *Windows* Software Development Kit, or SDK. And since the SDK lists for \$500, it's prohibitively expensive for the nonprogrammer who simply wants to create a few new icons for the *Windows* Program Manager.

In this issue, we present IKE, an icon editor that every *Windows 3.0* devotee can use either to create icons from scratch or to read in icon files for editing. The average icon is 32 by 32 pixels and contains 16 colors, so this is the format for which IKE is designed. IKE displays two separate viewing areas: an actual-size display of the image being edited and a larger editing window that contains a magnified view of the icon. IKE provides you with a variety of drawing tools and lets you work with a palette of 16 available colors. IKE's editing screen is shown in Figure 1.

IKE does have one significant limitation. In the *Windows* environment, icons are used in two principal ways. The first is in the Program Manager, where icons represent executable files. In the Program Manager, any icon, including those you

Create and Customize Your Own Icons for Windows 3.0

■ You no longer have to be a programmer and have the *Windows* Software Development Kit to give your programs the icons you want.

create with IKE, can represent any program. The second is when you minimize a running *Windows* application. It is here that IKE reaches its limit.

When you minimize a program, *Windows* searches the resource information at the end of every *Windows 3.0* .EXE file for the icon that was specified by the original application programmer. Unfortunately, IKE cannot go into that application's .EXE file and replace or edit the resource information it contains. The format of this resource information is not documented by Microsoft, and it is subject to change in future versions of *Windows*. This means that the icon you create with IKE won't be used by the application when it is in a minimized state. It also means that you can't edit the specific icons *Windows 3.0* itself supplies. You can, however, use IKE to create and modify icons, which the Program Manager can use to represent a program.

IKE can be downloaded from PC MagNet (for instructions, see PC MagNet News, which immediately follows this article). The executable program and its full C source code are included in the archive file, IKE.ARC. If your communications setup can't handle binary files, you can

download IKE.BAS; running this program in BASIC will create the IKE.EXE file for you. As an alternative, we can mail or fax you the source code listings. Simply send a postcard with your name, address, and fax number (if applicable) to the attention of Katherine West, Utilities, *PC Magazine*, One Park Avenue, New York, NY 10016.

USING IKE

To start IKE from the DOS command line, simply enter

```
WIN IKE [filename]
```

where the optional *filename* is the name of an existing icon file. Alternatively, you can start IKE from the *Windows* Program Manager by double-clicking the mouse on IKE's own icon. If you do not initially supply an icon filename, you can still select an existing icon file for editing with the File/Open menu choice. If you wish to create a new icon, simply start drawing in the edit window.

The toolbox palette at the bottom of the display lets you click-select from among eight different drawing tools. The pencil tool lets you draw an individual pixel, and the line-drawing tool produces one-pixel-wide lines. The hollow and filled rectangle drawing tools and their ellipse counterparts let you work with a variable-width brush. The fill tool lets you flood an area of your icon that's enclosed in or surrounded by a black border, with a selected color; and the net tool, used with the Edit/Copy and Edit/Paste menu choices, lets you copy and paste a portion of your image elsewhere. To do this, draw your icon and select the

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net tool. Then in the edit window, outline the area you wish to copy by pressing and dragging the mouse button. Next, select Edit/Copy and again, in the edit window, create an outline of the *same* size in a different location. Lastly, select Edit/Paste and the image will be copied to this new location. You can pick any of 16 colors from the color palette at the bottom of the screen. Your current tool and color choices are highlighted with a black border around their buttons.

After you finish editing an icon, you must save it to an icon file. Choose the File/Save or File/SaveAs menu item and enter a filename for the icon, if requested.

To associate an icon with a program in the Program Manager, you choose the File/Properties menu item from within the Program Manager. Click on the "Change Icon . . ." button and enter the full pathname of the icon you want to associate with that program. Then click on the OK button, click OK again in the Properties box, and you're all set. The new icon will then be associated with that program whenever the Program Manager starts up.

THE ICON FORMAT

Reference Manual 2 in the *Windows 3.0* SDK provides the details of the icon file format. The icon editor must be able to both load and write files in this format. Because the information in this manual is not otherwise widely available, it will be discussed here in somewhat greater detail

than usual. Programmers may wish also to download the full C source files, though Figure 2 contains the specific code sections under consideration.

At the beginning of the icon file is a short header that indicates the number of icons stored in the file. Each icon in the file also has a directory entry in the header, which specifies the size of the icon, the number of colors it uses, and the location where the bitmap image for the icon is found in the file.

One of the new features introduced with *Windows 3.0* is the use of a device-independent bitmap (DIB) for each icon image. A device-independent bitmap describes the actual appearance of an image rather than the way the bitmap is represented internally by a certain display device. *Windows 3.0* can map the stored DIB description so that it will be rendered correctly on a wide variety of display hardware. The same 16-color device-independent bitmap should thus be able to be displayed on a 256-color Super VGA system and on a monochrome system.

Each device-independent bitmap comprises an information header, an array of RGB (red-green-blue) color values, and the stream of bits that forms the actual image. Among the data contained in the information header is the size of the bitmap, the number of bits used to draw each pixel, and the type of compression algorithm used to pack the image bits.

Bitmaps can either use no compression or use a simple run-length encoding mechanism. In a *run-length encoding* scheme the bitmap is represented by a series of "counts," which in turn represent the

number of "runs" of the same pattern. For example, if a bitmap image contains 20 successive red bits, an uncompressed bitmap would require 10 bytes to represent them (since it takes 4 bits to represent a pixel). A run-length encoded bitmap, on the other hand, would represent the same area with 1 byte containing the number 10 followed by 1 byte representing two red pixels—just 2 bytes. Run-length encoding is especially useful when a bitmap image contains large blocks of a single color. Since icon bitmaps are so small, however—512 bytes for a 16-color bitmap of a 32-by-32-pixel icon—compression is typically not usually used for them.

Windows uses a different scheme for representing color information from that employed by text-mode programs. Most of the BIOS video functions used by text-mode applications use a simple numbering of colors from 0 to 15. You have a choice of 16 different colors for the foreground and 8 or 16 colors for the background (depending on whether blinking mode is suppressed). Even if your system has a VGA card capable of displaying 256 different colors, it can only use the 16 colors mapped into the current color palette.

Windows, however, is a graphics system and is not restricted to the 16-color text-mode scheme. All colors are composed of 3 primary colors—red, green, and blue. *Windows* uses a 24-bit RGB value to represent the overall color: 8 bits for the red component, 8 bits for the green component, and 8 bits for the blue component. Since there are thus 256 possible values for each component, 16 million ($256 \times 256 \times 256$) different colors can be displayed.

To produce all of these different colors, *Windows* combines the color capabilities of the video card with a technique known as *dithering*. Dithering creates colors by alternately illuminating different-color pixels in close physical proximity. For example, you can dither the color pink with an alternating series of red pixels and white pixels.

If n bits are used to represent one pixel, then the pixel can be drawn in 2^n different colors. Conversely, to represent x different colors, a pixel must be represented by $\log_2 x$. But as we just noted, *Windows* uses 24 bits to represent a color, so why doesn't every pixel have a 24-bit value?

A bitmap in which every pixel required 24 bits would take up an inordinate amount of memory and disk space. Moreover, most bitmaps don't need to display 16 mil-

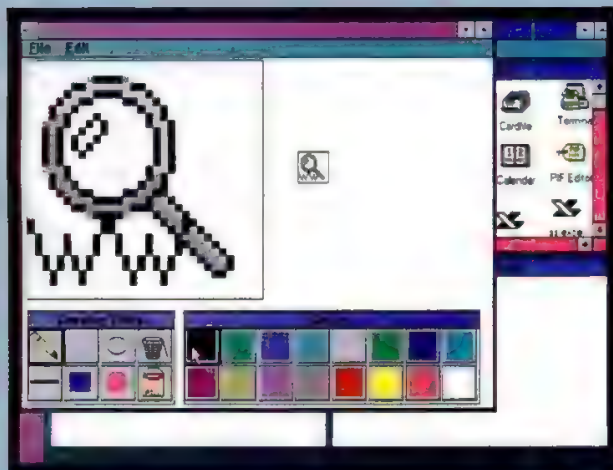


Figure 1: Creating and editing icons is no longer the sole domain of the *Windows* SDK. With a palette of 16 colors and a number of drawing tools, *IKE.COM* lets you develop your own images (like the one shown for *PC Magazine's* WINWHERE utility).

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lion colors at once; 16 simultaneous colors will suffice nicely for icons. Therefore, each pixel value is translated into a corresponding 24-bit RGB value through a table that contains one entry for each numerical value the pixel can have. The pixel value in the bitmap thus represents an index into this table, not the value of an actual color.

As an illustration, take the 16-color icon for which IKE is designed. The bitmap image itself will use 4 bits to represent each pixel by a number from 0 to 15. These numbers are actually indexes into an array of 16 RGB values that follow the bitmap information header. If an icon required 256 different colors, each pixel in the image would require 8 bits to represent it, and there would be a 256-element array of RGB values following the bitmap information header.

Icons must supply one other piece of information stored directly after the image bitmap. This is an AND mask, which is used to support transparency. Imagine that you create an icon in IKE that consists of a simple hollow circle. If the area contained within the circle is "transparent" (as opposed to "opaque"), then the pixels on the screen beneath will show up in the hollow space.

The AND mask is a series of bits, 1 bit per pixel. If a bit in the AND mask is 1, then the corresponding pixel in the icon will be transparent. A zero bit in the AND mask means that the corresponding pixel in the icon will be displayed opaque. Since IKE does not support transparency, its AND mask is simply a 128-byte array of zeros.

HOW IKE WORKS

The design goal for IKE is to let you create and modify icons. In *Windows 3.0*, this reduces to the task of manipulating a device-independent bitmap image, a simple sequence of bits. It is relatively simple to maintain all of the necessary icon and bitmap header information and to write it out in the proper format when the icon is written to the disk file. *Windows* itself has the necessary functions to display the DIB image on the screen in its original size and in a larger or smaller one.

The first thing that needs to be done in any *Windows* program is to register all of the window classes that will be used during the life of the program. The function

IKEInit(), found in the source file *ICO.C*, contains the code to fill a *WNDCLASS* data structure with the necessary values and call the *Windows RegisterClass()* function. A window class is really a data structure that defines certain characteristics of the window. These characteristics include the shape that the mouse cursor will assume when it enters a window of that class, the icon that a minimized window of that class will use, the name of a menu that each window of that class will be "born" with, the color that the window background will be drawn in, and the name of the window procedure for that class.

A *window procedure* is the message handler for a class of windows. All mes-

Windows 3.0's owner-drawn controls allow the application itself to be responsible for the drawing of each item within a menu, list box, or button control.

sages sent to a window are actually relayed to the window procedure associated with that window. The programmer can thus choose to intercept and handle any message or to pass it on to the default message handler that *Windows* provides. This default handler is called *DefWindowProc()*; you can examine its source code if you own the *Windows* SDK.

By intercepting and processing certain messages, a *Windows* programmer can give a completely custom look and feel to a class of windows. For instance, a *Windows* programmer who is dealing with a factory-automation application might program a window class whose members would appear on the screen as circular gauges. The arrow on the dial would represent the current value of some object in the system. *Windows* gives you the freedom to implement and control windows that look and behave differently from the usual rectangular windows.

After all of the various window classes

have been registered, the data structures that represent the icon must be set to certain values. This is done in the function *NewIcon()* found in the file *ICO.C*. An empty 16-color bitmap is created for the user to draw upon, and the header and directory that will become part of the icon disk file are initialized.

After the initial blank icon is created, all of the windows that IKE will use must be created. This is done in *Windows* through the *CreateWindow()* function. IKE needs a main window, a smaller 256-by-256-pixel window in which the icon will be edited, a still smaller 32-by-32-pixel window to display the actual icon image, and the two toolbox controls. (The editing window simply uses an 8-by-8 rectangle to represent each pixel in the actual 32-by-32 icon image, hence its 256-by-256-pixel size.) These windows will each be created with the *WS_VISIBLE* style bit on so that they will be visible upon creation.

The final initialization step, which is one of the most interesting parts of the program, is the creation of the toolbox controls.

THE TOOLBOX CONTROLS

One of the most welcome enhancements to the *Windows* API is its support of owner-drawn controls. *Windows 3.0* allows the application itself to be responsible for the drawing of each item within a menu, list box, or button control. For example, if a list box in a word processing application is used to allow the user to select a font style, each entry in the list box can be drawn in a different font. The phrase "Times Roman" in the list box can actually be displayed in the Times Roman typeface, while the item right below it, the word "Courier" would be displayed in the Courier typeface. A pull-down menu that presents a list of colors can actually display bitmaps drawn in a certain color rather than the words "Green," "Red," "Blue," and so on. Creative programmers can thus use owner-drawn controls to enhance both the visual aspect and the ease of use of their *Windows* applications.

IKE uses a group of owner-drawn push buttons, enclosed within an overlapped window, as a "palette" or "toolbox" of selectable drawing tools. In the first palette, the tool icon is displayed on the surface of the button. The second toolbox contains a conventional color palette with a colored rectangle on the surface of each button. The border around the currently selected button is colored in black.

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Before creating a toolbox, you must decide on several parameters. You must first determine how many rows of owner-drawn buttons the toolbox will contain. When you add a button to the toolbox, you do not need to specify where the button is placed; the logic in the toolbox code determines that automatically. The first button goes in the top-left corner. When another button is added, it is placed directly below the previous button. When a column of buttons has been filled, the toolbox control puts the next button in the top row of the next column.

You must decide on the height and width of each button. In this case, we'll be drawing a 32-by-32-pixel icon on top of each button. To add a little 3-D style border around each button, we make each owner-drawn button 40 by 40 pixels.

The final decision is the maximum number of buttons that will go into the toolbox. Obviously, you must make the enclosing window large enough to accommodate all of the buttons. Since toolbox controls look best when the buttons fill the entire toolbox, if you have ten buttons in a control, it's better to make the toolbox two rows deep and five columns wide, rather than creating a four-by-three matrix.

All of the code that deals with the toolbox control can be found in the source file `TOOLBOX.C`. The first task is to create the enclosing toolbox window. The window is given the `WS_BORDER`, `WS_CAPTION`, and `WS_OVERLAPPED` styles. The inclusion of `WS_OVERLAPPED` allows the user to drag the toolbox control to a different location within the application.

When we registered the toolbox class, we told *Windows* that the window procedure for all toolbox windows was to be a function called `ToolBoxWndProc()`. This function, and all of the other code related to toolboxes, can be found in the file `TOOLBOX.C` in the *IKE* source code. Every time *Windows* creates a window, it sends the `WM_CREATE` message to the window procedure of the newly created window.

The purpose of the `WM_CREATE` message is to allow the newly created window to perform some per-window initialization. In the case of a toolbox window, a small data structure that contains some state information for the toolbox is at-

tached to the window. A small amount of memory is allocated for this data structure, which is attached to the window by using the `SetWindowWord()` function. This data structure will contain drawing information for each button in the toolbox.

Note that whenever you allocate memory that's attached to a window, you must remember to free the memory when the window is destroyed. A window procedure is notified with the `WM_DESTROY` message when the window is being destroyed. The following code in the toolbox window procedure accomplishes this:

```
case WM_DESTROY:
    hTB = GetWindowWord(hWnd, 0);
    GlobalFree(hTB);
    break;
```

After the toolbox window is created, a series of `TBM_CREATEBUTTON` messages are sent to it. `TBM_CREATEBUTTON` is not a standard *Windows* message; it is an application-defined message equal to the value `(WM_USER + 100)`. *Windows* allows an application to define its own private messages, provided these messages have values above the constant

CODE EXCERPTS FROM IKE'S SOURCE FILES

```
(a)
typedef struct tagDRAWITEMSTRUCT
{
    WORD    CtlType;
    WORD    CtlID;
    WORD    itemID;
    WORD    itemAction;
    WORD    itemState;
    HWND    hwndItem;
    HDC      hdc;
    RECT    rcItem;
    DWORD    itemData;
} DRAWITEMSTRUCT;

(b)
case WM_SETCURSOR:
    switch (iCurrentTool)
    {
        case ID_PENCIL:
            SetCursor(LoadCursor(NULL, IDC_ARROW));
            break;
        case ID_LINE:
            SetCursor(LoadCursor(NULL, IDC_CROSS));
            break;
        .
        .
        .
        default:
            SetCursor(LoadCursor(NULL, IDC_ARROW));
            break;
    }
    return TRUE;

(c)
InvalidateRect(hWndEdit, (LPRECT) NULL, FALSE);
UpdateWindow(hWndEdit);
InvalidateRect(hWndActualImage, (LPRECT) NULL, FALSE);
UpdateWindow(hWndActualImage);

(d)
hPen = CreatePen(PS_SOLID, 1, RGBColors[iCurrentColor]);

(e)
hBrush = (iCurrentTool == ID_FILLCIRC) ?
    CreateSolidBrush(RGBColors[CurrentColor]) :
    GetStockObject(NULL_BRUSH);

(f)
holdPen = SelectObject(hMemDC, hPen);
holdBrush = SelectObject(hMemDC, hBrush);
```

Figure 2: These *IKE.C* code sections take care of such tasks as creating a specific brush or displaying a button correctly.



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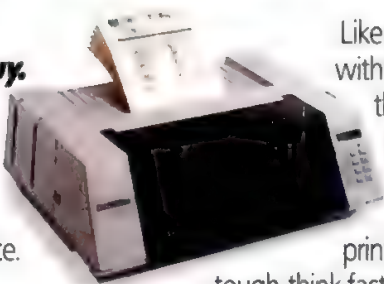
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WM_USER. *Windows* itself reserves all values below WM_USER for its own messages (except for the new messages that *Windows* 3.0 defines in order to support the Multiple Document Interface (MDI) specification).

When a TBM_CREATEBUTTON message is sent to the toolbox window, the value of the wParam argument must be a unique control identifier associated with the button. In the case of our drawing-tool toolbox, we want to draw an icon on top of the button, so the lParam value must be a far pointer to the name of that icon. In the case of our color palette toolbox, where we will draw a colored rectangle on top of the button, the HIWORD of lParam will be an index into an RGB color table.

When the toolbox window receives the TBM_CREATEBUTTON message, it calls CreateWindow() to create an owner-drawn push button. The button is created at the next vacant space within the toolbox and is given the BS_PUSHBUTTON | BS_OWNERDRAW style bits.

If the LOWORD of the lParam value of this message is not NULL, then lParam is considered to contain a far pointer to the name of an icon. The specified icon is loaded in the resource file. The handle of this icon is then stored in the data structure that is attached to the toolbox window.

When *Windows* needs to display an owner-drawn button, it sends the button's parent the WM_DRAWITEM message. The value of the lParam is a far pointer to a DRAWITEMSTRUCT data structure. This data structure contains all the salient information that an application needs to display the button correctly. Figure 2 (a) contains a code excerpt of DRAWITEMSTRUCT.

TheCtlID field tells us precisely which button needs to be redrawn. Our code will match the control identifier of this button with the handle of the icon that represents it. The hDC field is a handle to the device context for the drawing operation. Most of the GDI functions in *Windows* require a device context in order to write output to a device. The device context is an interface between a *Windows* application and the underlying hardware output device.

The itemState field is a bit flag value that indicates whether the button is being

selected (that is, that the left mouse button has been depressed but not released over the button) and whether the button currently has the input focus. An application should always display an owner-drawn button differently when it is being selected than when it is in an unselected state. In this particular toolbox implementation, the visible difference is that the top of the button is shifted to the right and down, making it appear to be pressed in. The rcItem field contains the drawing rectangle.

In IKE's code, the function DrawUserButton() is responsible for rendering owner-drawn buttons. I looked at the ZOOM-IN program that comes with the *Windows* SDK to see just how Microsoft created the new 3-D push button appearance and applied the same technique in IKE. After the borders and the interior of the button are drawn, I used the DrawIcon() function to

Apart from the toolbox window procedure, IKE uses three window procedures.

draw an icon within the button (in the drawing-tool toolbox) or FillRect() to draw a colored rectangle (in the color palette toolbox).

THE WINDOW PROCS

Apart from the toolbox window procedure just discussed, IKE uses three window procedures. The code for all of the window procedures can be found in the file ICONPROC.C. ICOViewWndProc() is the window procedure for the main window of the application. The primary task of the main window procedure in this application is to act as a command dispatcher. Whenever a menu item is selected, *Windows* sends a WM_COMMAND message to the window that owns the menu bar, informing the application that a command was selected. The value of wParam is the unique command identifier associated with the menu item. Most *Windows* applications contain a large switch statement that serves as a dispatcher for the WM_COMMAND message.

The selection of a menu item is not the only way that a WM_COMMAND mes-

sage is sent to ICOViewWndProc(), however. It is also sent from ToolboxWndProc() when the user presses a button on a toolbox. In this case, the code in ICOMainWndProc() keeps track of the current color and the current drawing tool.

The window procedure for the window that displays the actual icon image is called ICOImageWndProc(). It does not process any messages except WM_PAINT, which *Windows* sends to a window when all or part of the client area of a window needs to be redrawn. In this case, the current contents of the bitmap that represents the image of the icon must be displayed in the window. We will discuss how the bitmap is drawn in more detail below.

The most complex window procedure in IKE is ICOEditWndProc()—the one associated with the icon-editing window. Its main job is to deal with the mouse button presses and releases, mouse movement, and cursor drawing.

The normal shape of the mouse cursor within a *Windows* application is an arrow that tilts toward the northwest. *Windows* has several predefined mouse cursors that your program can use, however, and you can even create your own mouse cursors with the SDKPaint utility that comes with the *Windows* 3.0 SDK. Indeed, with a little modification, IKE itself can be used to create new cursors. When you register a window class, one of the attributes that you assign is the mouse cursor.

Windows lets applications alter the shape of the cursor when it enters a window. IKE uses this capability to make the cursor shape reflect the currently used drawing tool. When the mouse is moved within a window, *Windows* sends three separate messages to the window procedure of that window: the WM_NCHITTEST message, the WM_SETCURSOR message, and the WM_MOUSEMOVE message. The WM_SETCURSOR message allows the application to change the mouse cursor. The WM_NCHITTEST is sent to a window in order to determine the component of the window the mouse has moved atop. *Windows* needs to know, for example, when the mouse is over a resizable window's borders so that it can change the mouse cursor to a bidirectional arrow.

The code fragment shown in Figure 2 (b) is responsible for altering the mouse cursor shape to match that of the current drawing tool. The LoadCursor() function will normally load a cursor bitmap from the resource information at the end of a *Windows* .EXE file. If the first argument

Utilities

passed to `LoadCursor()` is `NULL`, then *Windows* will access one of its predefined mouse cursors. Because *IKE* uses the predefined *Windows* mouse cursors, the first argument in all of the `LoadCursor()` calls is `NULL`. The `SetCursor()` function changes the shape of the mouse cursor.

When you press the left mouse button while the mouse is in the icon editing window, a `WM_LBUTTONDOWN` message is sent to the window procedure. If the current drawing tool is the pencil, the pixel at the current mouse position will be set to the current drawing color. If another drawing tool is being used, then a dragging operation is initiated and the outline of a shape will be sketched on the window. This outline will not actually be incorporated into the icon image until the mouse button is released. As the mouse is dragged, the window procedure receives a continuous stream of `WM_MOUSEMOVE` messages. In *IKE* this message is used to extend the boundaries of the outline of the shape.

A `WM_LBUTTONUP` message is sent to the window procedure when the mouse button is released. When this occurs, the icon bitmap is filled in with pixels of the current drawing color in a pattern matching the current drawing tool. If the current drawing tool is a filled or hollow rectangle, then a rectangular pattern of pixels is set in the bitmap. Because a rectangle is a simple shape made up of four line segments, we can use a simple nested `for` loop to set the bits in the bitmap ourselves.

An ellipse is a more complex shape—one that is represented by a mathematical formula. In this case it is better to let *Windows* itself fill in the bits in the bitmap. Therefore, if a hollow or filled ellipse is desired, a memory-based device context is created and *Windows* is instructed to draw an ellipse on this memory image. If the line-drawing tool is selected, then a pixel will be set in the bitmap for each point on the line.

We can now turn our attention to the actual internal structure of the icon and discuss how *IKE* manipulates its pixels.

WRITING AND READING THE ICON FILE

The `ICOWrite()` function is responsible for taking the current icon image and dumping it to an external disk file. This function takes two arguments: the name of the icon

file and a handle to the bit mask that represents the icon image.

`ICOWrite()` must create both a `BITMAPINFOHEADER` structure and a 16-element `RGBQUAD` array, fill it with the appropriate information, and write it directly after the icon directory entry in the `ICO` file. The `biHeight` and the `biWidth` of the bitmap can be taken directly from the `IconDir` structure in our program. Since the *Windows* SDKPaint program writes out `ICO` files whose `biHeight` field is multiplied by two, *IKE* follows this procedure for the sake of compatibility.

The description of the `BITMAPINFOHEADER` structure given in the *Windows* SDK dictates that the `biPlanes` field is to be set to 1 regardless of the number of color planes the display device supports. The `biBitCount` field contains the number of bits used to represent a single pixel. The possible values for this field are 1, 4, 8, and 24, and since *IKE* is designed to handle 16 colors, this field is set to 4. As no compression scheme is being used, the `biCompression` field must be set to the value `BL_RGB`. The remaining fields of the `BITMAPINFOHEADER` structure can be set to zero.

Finally, we write out the bitmap image and the `AND` mask. Since this release of *IKE* does not support transparency in icons, the `AND` mask contains all zeros.

Reading the icon file is basically the converse of the process of writing it. The icon file header is first read in, and then the directory entry for the icon is read. If an icon file that does not use 4 bits per pixel is encountered, an error message will be displayed and the icon will not be read in. Memory is allocated to hold the icon bitmap, and then the bitmap is read in. The memory handle to the bitmap image is stored in the `IconInfo.hBitmapBits` field. This handle will be accessed throughout *IKE* whenever we need to deal with the current bitmap image.

DISPLAYING THE ICON

The function `DisplayDIBitmap()` (found in the file `ICO.C`) is responsible for drawing the icon bitmap both in the edit window and in the icon image window. Both windows are "invalidated" whenever the user makes a change to the icon bitmap. When you invalidate a window, you are telling *Windows* that some portion of the window has been changed and needs to be repainted. Whenever a change is made to the icon bitmap, the sequence of function calls that

is shown in Figure 2 (c) is issued.

`InvalidateRect()` tells *Windows* that a certain portion of a window is displaying an out-of-date or incorrect image, that needs to be redrawn. The second argument to this function tells *Windows* exactly which portion of the window is bad. If the second argument is `NULL`, then the entire client area of the window is invalidated. If the second argument is not `NULL`, it must be a far pointer to a structure that contains the coordinates of a rectangular area to be invalidated. For every window currently displayed, *Windows* keeps a list of rectangular regions that are invalid and need to be updated.

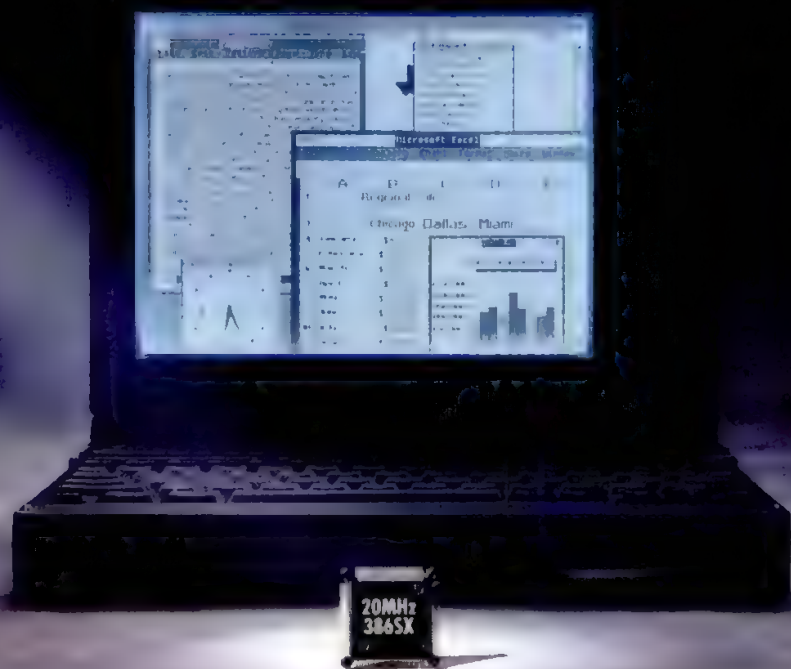
When an application calls `GetMessage()` in the main message polling loop, *Windows* scans for windows that have invalid regions and sends a `WM_PAINT` message to each of these windows. The `WM_PAINT` message tells the window that all or part of its client area needs to be redrawn. Notice that the `WM_PAINT` message is not sent immediately, but only when your application goes to poll for more messages. In fact, the `WM_PAINT` message is a low-priority message that gets placed on the back of the message queue. (An application can force an immediate update to the window by calling the `UpdateWindow()` function. `UpdateWindow()` checks for an invalid region, and if one is found, it sends a `WM_PAINT` message to the window.)

IKE takes a very simple approach when it calls `InvalidateRect()`. Even if you have changed only a single pixel within the bitmap, *IKE* invalidates the entire window, causing the entire area to be repainted. The window procedures for both the edit and the image window process the `WM_PAINT` message by calling *Windows* function `DisplayDIBitmap()`. This function allocates and fills a `BITMAPINFOHEADER` structure, and simply calls another *Windows* function, `StretchDIBits()`, to display the contents of the bitmap within the window.

`StretchDIBits()` will display the bitmap directly on the output device. In addition, it will shrink or stretch a bitmap to fit within a certain area. For the icon-editing window we want to display a 32-by-32-pixel bitmap in a window whose client area is 256 pixels high and 256 pixels wide, so the original bitmap must be stretched to eight times its normal size.

The use of device-independent bitmaps in *Windows* 3.0 eliminates a whole series of intermediate programming steps re-

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TEXAS
INSTRUMENTS

Utilities

quired by previous versions of *Windows* before a bitmap could be displayed on the screen. First, a memory device context had to be created, using the `CreateCompatibleDC()` function. A memory device context contains a range of memory that is drawn into much the same way as you traditionally would draw into the memory on a video adapter. With drawing into a memory device context, however, the results were not immediately displayed on the screen; you first had to use the `SelectObject()` function in order to associate the bitmap with the memory device context. In other words, the bitmap became the drawing surface in the memory display context. Finally, you had to call the `BitBlt()` or `StretchBlt()` functions to transfer the bitmap from the memory device context to the screen device context.

These intermediate steps are totally unnecessary when you use device-independent bitmaps. There are two functions that render a bitmap directly on an output device: `StretchDIBits()` and `SetDIBitsToDevice()`. The latter function does not shrink or stretch the bitmap image, whereas the former does when it's needed.

DRAWING ON THE BITMAP

When you draw a shape or set a single pixel to a certain color with the pencil tool, IKE must set the corresponding bits within the bitmap to the current color. The IKE source code contains functions for setting a pixel in the bitmap to a certain color and for querying the color value of a certain pixel. These functions are called `SetIconPixel()` and `GetIconPixel()`, respectively. Given *x*- and *y*-coordinates, `SetIconPixel()` determines the byte in the bitmap that contains the color information for that pixel. It then sets the appropriate bits of that byte to the desired color.

When you use the pencil tool to draw a pixel on the icon-editing window, IKE simply calls `SetIconPixel()` to set the pixel to the current drawing color. When the user draws a hollow rectangle, IKE uses four different `for` loops to set the pixels that make up the rectangle outline to the current color. Processing a filled rectangle is similar except that IKE uses a nested `for` loop to fill the interior of the rectangle as well.

The processing that accompanies the line-drawing tool is slightly different. A

simple `for` loop can be used to fill in the pixels if the user draws an absolute vertical or horizontal line. However, when *Windows* draws diagonal lines, it must use a special line-drawing algorithm to determine pixels to set on the display that most closely approximate the actual line. IKE needs a way to find out precisely which pixels *Windows* uses to render the diagonal line so that it can set the appropriate bits in the icon bitmap. Fortunately, *Windows* has a function that lets IKE do this.

The `LineDDA()` function takes six arguments. The first four are the starting and ending points of a line. The fifth argument is a pointer to a function within your application that `LineDDA()` will call for each pixel that *Windows* draws on the line; in IKE's case, this is the function `IconPlotLine()`. The sixth argument is a user-defined value, which IKE uses for the value of the current drawing color.

`LineDDA()` does not actually draw the specified line; rather, it calls `IconPlotLine()` for each pixel in the line. It passes the *x*- and *y*-coordinates of the pixel, together with the user-defined value speci-

fied as the sixth argument to `LineDDA()`. `IconPlotLine()` simply calls `SetIconPixel()` in order to set the corresponding pixel in the bitmap to the current color.

The only two drawing tools left to consider are the hollow and filled ellipse tools. How do we map the pixels that comprise the ellipse onto the bitmap? Unfortunately, *Windows* does not provide a function similar to `LineDDA()` for other shapes.

A few paragraphs back, I mentioned the intermediate programming steps needed to display the device-dependent bitmaps used by versions of *Windows* before 3.0. Fortunately, you can use the same technique to handle the problem of drawing ellipses on a device-independent bitmap. You create a memory device context and associate the device-independent bitmap with it. This sets the contents of the memory-based output device to the bitmap image. Then, whenever you use a *Windows* GDI function to draw on the memory device context, it is the surface of the bitmap image that is really drawn upon. After the drawing operation has been completed, you set your device-independent bitmap to

PC UTILITIES UPDATES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ALIAS.COM, Version 1.1
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BCOPY, Version 1.2
BEN55.ARC (Benchmark Series, Version 5.5)
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2
CMDEDIT.EXE, Version 2.1
CONFIG.CTL, Version 3.0
CONVERT.COM, Version 1.1
DIRMATCH.COM, Version 2.0
EMMA.COM, Version 2.2
EMS40.SYS, Version 1.1
LASERLST.COM, Version 1.1
LITES.COM, Version 1.1
LOG.COM, Version 1.1
MONO.COM, Version 1.1
MOUSE.CTL, Version 1.1
PANDORA.COM, Version 1.5a

PCACCESS.COM, Version 1.1
PCMANAGE.EXE, Version 1.1
PCREMOTE.COM, Version 1.1
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For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT.ARC.

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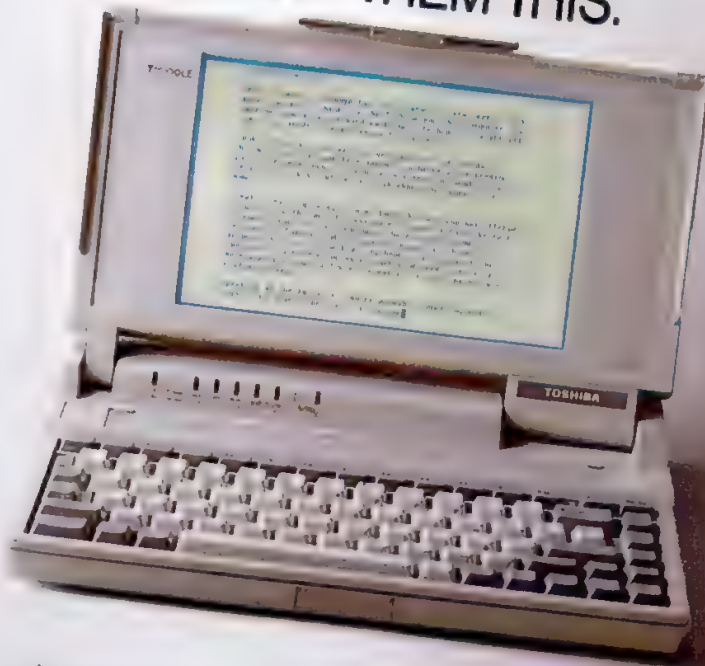
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Utilities

the bits that comprise the drawing surface of the memory device context. The memory device context is then deleted, and the icon-editing window is updated with the new bitmap image.

Two attributes associated with a device context are the *current pen* and the *current brush*. *Windows* uses the current pen to draw the outline of a graphical object. A *Windows* pen has three attributes: its width, color, and line-drawing style. IKE uses the call shown in Figure 2 (d) to create a 1-pixel-thick solid pen that has the current drawing color.

Windows uses the current brush to fill the graphical object being drawn. A brush also has three attributes: its style (that is, hatched, solid, bitmap), its color, and the hatch style. If the user is drawing a hollow ellipse, then we want to use a NULL brush. But if the user is drawing a filled ellipse, then we use a solid brush with the current drawing color. The code shown in Figure 2 (e) is used to create the appropriate brush.

Having created the desired pen and brush, the next step is to associate them with the memory device context. This is the task of the *SelectObject()* function shown in Figure 2 (f). *SelectObject()* returns the old object in the device context. Before a *Windows* application is finished using a device context, it should reset the device context to contain the original objects.

To draw an ellipse, the following call is made:

```
Ellipse(hMemDC, x1, y1, x2, y2);
```

The ellipse will be drawn using the current pen for the outline and the current brush to fill the interior.

ENHANCEMENTS

Most users will be completely satisfied with IKE's present capabilities. It does exactly what it's supposed to do—help you create and edit icons. However, there are some enhancements you might consider making, and the following hints will get you started:

The most serious limitation is that IKE can accommodate just a single icon in an icon file. To overcome this, you could expand the *IconInfo* data structure into an array, or you could maintain a linked list of

IconInfo structures. The latter may be a better choice, since the user really should be able to add or delete an icon from the icon file dynamically. The functions *ICORead()* and *ICOWrite()* would then need to contain a loop that would input or output the entire list of icons.

A second limitation is that IKE ignores the AND mask that contains an icon's transparency information. If an icon contains transparent sections, the pixels from the screen underneath those sections really should show through. To implement this, however, all of the IKE code that manipulates the device-independent bitmap would need to be modified to handle the corresponding bits in the AND mask as well.

IKE is currently set up to work only with 16-color icons. It would be a trivial chore to expand the support to include monochrome bitmaps—indeed, most of the code that is needed to do this is already in IKE. 256-color icons would be a little more difficult, since the color-palette toolbox would grow to an unwieldy size if it had to accommodate that many colors. In addition, IKE could be improved by enabling the user to load, edit, and save customized color palette information. IKE's default color palette roughly approximates the 16 standard colors used by DOS text-mode applications. This, unfortunately, means that the user is stuck with these specific 16 colors when he creates new icons.

The final enhancement to consider is to expand IKE to create and edit *Windows* cursors. A cursor is a monochrome bitmap that can be used to track the movement of the mouse. The cursor information is usually stored in a file with a .CUR extension. The format for the header and the directory entries for binary icon files and binary cursor files are virtually identical. Since cursors are simple monochrome bitmaps, the *BITMAPINFO* structure used in icon files is absent from cursor files. The bitmap information for a cursor consists of an XOR mask followed by an AND mask of equal size. Minor surgery would need to be performed on the IKE source code in order to implement cursor editing, but it should not be beyond the capabilities of the average *Windows* programmer.

If you decide to make further enhancements to IKE, please consider yourself invited to post them to me on PC MagNet. ■

Marc Adler is the president of Magma Systems and is a frequent contributor to PC Magazine.

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PC MagNet News

The Latest Files and Features of PC Magazine's On-line Service

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Available as either public-domain, free utilities from *PC Magazine* or as nominal-fee shareware, the following programs can enhance your HP LaserJet. Check out LASERLST.COM to print two pages on one (April 11, 1990), PCBOOK.EXE for booklet printing (October 16, 1990), for envelope printing use ENVELOPE.COM, while LZSELECT.COM makes printer setup easy (January 29, 1991). These utilities are all located in our Utilities Database, as well as in the UTILFORUM (DL2). Check out other HP LaserJet programs, including Mail Machine HP labeling (MM30.ZIP) and font compression (CMPSRF.ZIP), in our user-supported library (DL16), also in UTILFORUM (GO PCM:UTILFORUM).

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by
Charles Petzold

Environments

If you saw the word *animation* in the title of this column and started thinking about kwazy wabbits running around your screen, your sights are probably set a little too high. Yes, you can do some animation using the *Windows 3.0* Palette Manager, but it's of a rather specific type.

We can define *animation* in this context as any type of movement or change on a video monitor, under the control of a program. The most direct and straightforward approach to animation is simply to draw an image, erase it, draw a new one, erase that, and so forth. This works fine when you're using simple images, but for any reasonably complex graphics image, this method is just too slow for real-time animation.

One way to speed up the movement is first to create a series of bitmaps of the images and then to draw these bitmaps on the display successively. Copying a bitmap to a display is usually much quicker than directly drawing a graphics image. This method does have a disadvantage, though: The collection of bitmaps can require a

An Introduction to Palette Animation Under Windows 3.0

■ Animation under *Windows 3.0* is fast but limited—you create the appearance of movement by manipulating the video board palette.

lot of disk space and memory.

Palette animation is quite different. You begin by drawing everything you need on the screen and then you manipulate the video board palette to change the colors

of these objects, perhaps rendering some of the images invisible against the screen background. In this way, you can get animation effects without actually redrawing any of the images. Palette animation is very fast.

A HARDWARE EXAMPLE

Let's first take a look at how we'd handle palette animation if we had direct access to the video board hardware. We'll assume we have a video board with a 16-color graphics mode.

Because the video board can display 16 simultaneous colors, every pixel requires 4 bits in the video buffer memory. Thus, the value of these pixel-bits can range (in decimal) from 0 through 15. The color associated with each of these 16 possible pixel-bit values is determined by the entries in the palette lookup table on the video board. The palette lookup table contains 16 RGB (red-green-blue) color values—one for each of the 16 possible pixel-bit values.

Suppose we load all 16 entries in the palette table with RGB color values corresponding to white. Now anything we draw into video memory will be displayed as white. In other words, nothing will be visible. So let's color the entire background with pixel-bit values of zero and then draw four filled circles using pixel-bit values from 1 through 4, as shown in Figure 1.

The screen still looks entirely white, because all the pixel-bit values map to white through the palette table. Now let's load an RGB value corresponding to red into the palette table for the pixel-bit

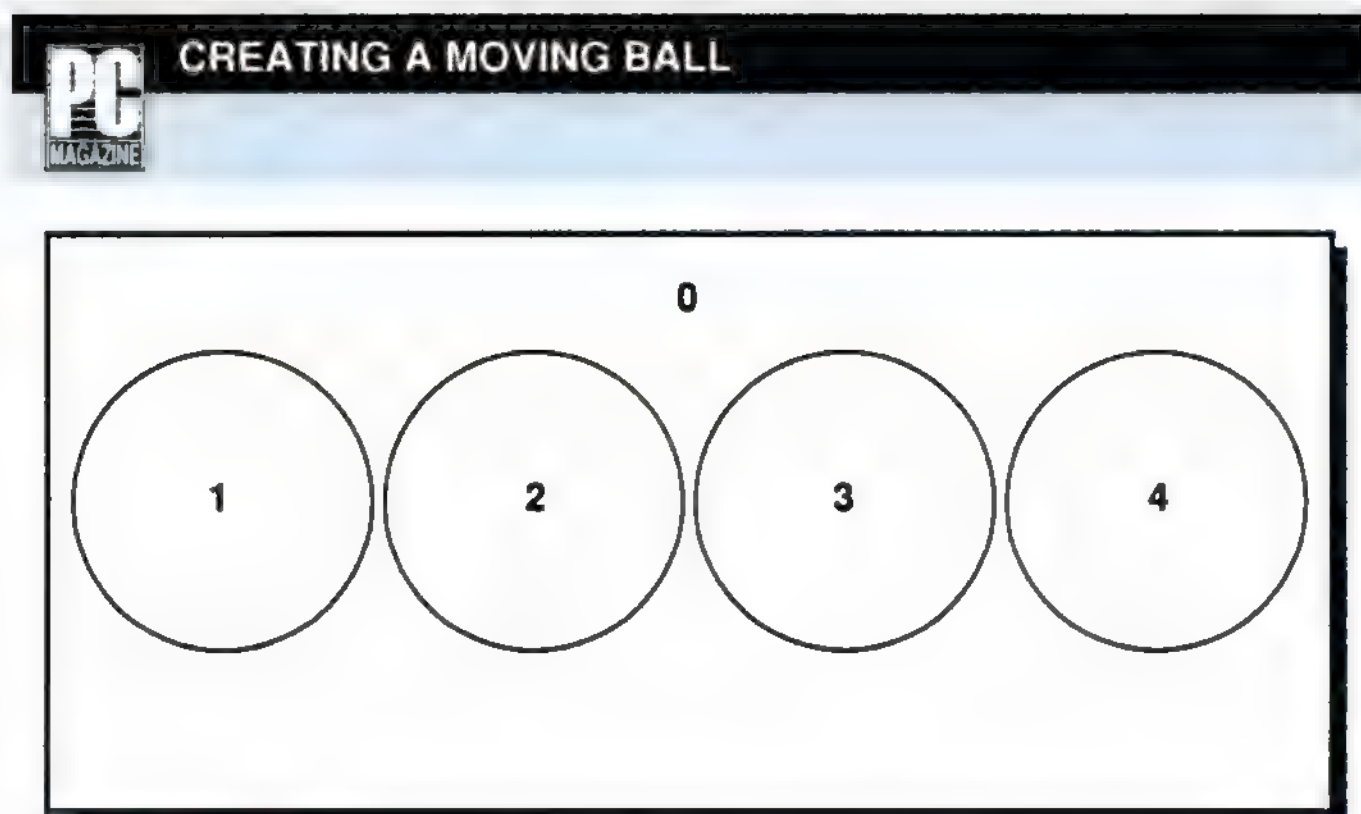


Figure 1: Here are the pixel-bit values for palette animation of a moving ball. By successively turning the color of each ball on and off, you can create the effect of a ball moving across the screen.

Environments

value of 1. Suddenly a red circle appears at the left of the screen. About a quarter of a second later, load the palette table with a white RGB value for the pixel-bit value of 1, and a red RGB value for the pixel-bit value of 2. The leftmost circle disappears and the circle next to it pops into view. Continue doing this, and you'll see something that looks like a red ball moving across the screen.

This is palette animation. Because loading a palette table entry requires only a few bytes of data, it's fast. You're not drawing or redrawing anything. You're just changing the colors of objects already drawn into video memory. But also notice the limitation: You can't use palette animation to draw the circle into an arbitrary location.

Let's suppose you want to smooth out the animation process by overlapping seven circles rather than four. In order to do this, you'll need to draw pieces of circles rather than whole circles, with the pixel-bit values as shown in Figure 2. You'll probably have to use elliptical clipping to draw these circle pieces. To illuminate the first circle, you simply load the palette table with red RGB values for the pixel-bit values of 1 and 2. For the second circle, you'd need red RGB values for the pixel-bit values of 2, 3, and 4. Notice also that we're quickly approaching the limit of the 16-color video board.

PALETTE ANIMATION IN GDI

Using palette animation in the Windows Graphics Device Interface (GDI) is conceptually very similar to directly accessing video board hardware. In the last issue, I showed how you can create a custom color palette in Windows 3.0 by calling the `CreatePalette` function. This function requires a structure of the type `LOGPALETTE` (logical palette), which in turn contains an array of structures of the type `PALETTEENTRY`. The `PALLETTEENTRY` array contains the RGB color values in the logical palette. After creating the logical palette, you select it into a device context using the `SelectPalette` function and then realize it with `RealizePalette`.

When you're creating a palette for use in palette animation, the initial creation of the palette is a little different. Normally, you set the `peFlags` flag of the `PALETTEENTRY` structure to 0 when you create a logical palette. This allows the GDI to map identical colors from multiple logical palettes into the same system palette entry. For example, suppose two Windows programs create logical palettes containing the RGB entry 10-10-10. The Windows system palette table really needs to have just one 10-10-10

entry. But if one of these two programs is using palette animation, you don't want GDI to create one entry for both programs. Palette animation is intended to be very fast—and it can only be fast if no redrawing occurs.

When the program using palette animation changes the palette, it shouldn't have any affect on other programs or force GDI to reorganize the system palette table. This means that the `peFlags` field of the `PALETTEENTRY` structure must be set to `PC_RESERVED` for each RGB color value that will be changed during the animation process. The `peFlags` value of `PC_RESERVED` reserves the system palette entry for the logical palette that will be using animation.

During the `WM_PAINT` message, you call `SelectPalette` and `RealizePalette` as usual. You specify color using the `PALLETTEINDEX` macro. This macro takes an index into the palette table.

For animation, you probably want to change the palette in response to a `WM_TIMER` message. To change the RGB color values in the logical palette, you call the function `AnimatePalette` using an array of `PALETTEENTRY` structures. This function is very fast because it only needs to change entries in the system palette and, consequently, the video board hardware palette table. You don't even need to obtain a device context handle to call `AnimatePalette`.

Now let's examine a real program that uses palette animation.

THE BOUNCE PROGRAM

Figures 3 through 5 show the components of `BOUNCE`, a program that displays a bouncing ball across your screen. For simplicity, this ball is drawn as an ellipse depending on the size of the client area.

If you have the Windows 3.0 Software Development Kit and the Microsoft C 6.0 Compiler installed, you can create

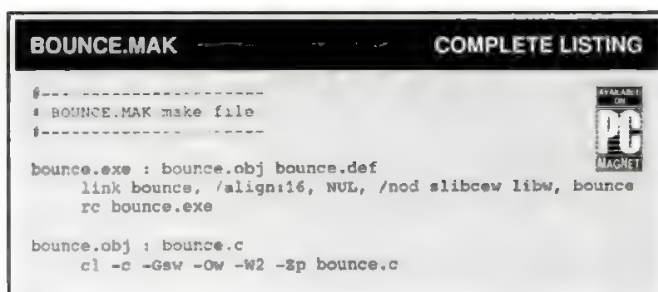


Figure 3: Use this file to automate the creation of the `BOUNCE.EXE` executable.

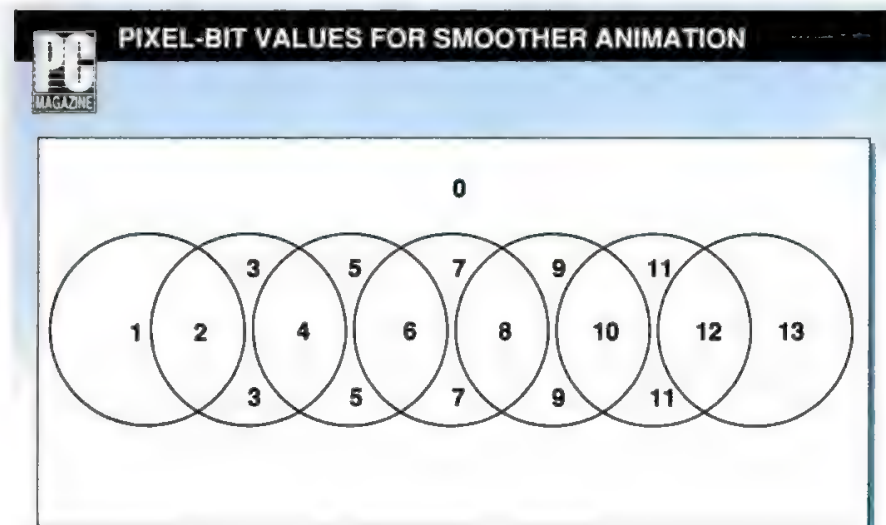


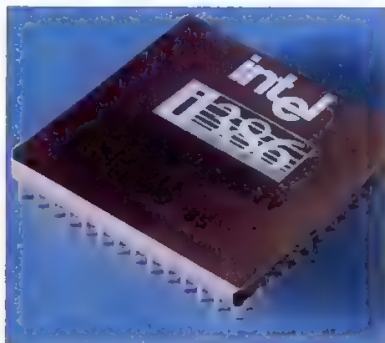
Figure 2: By overlapping seven circles rather than four, you can smooth out the animation. You'll need to draw pieces of circles—rather than whole circles—with the pixel-bit values.

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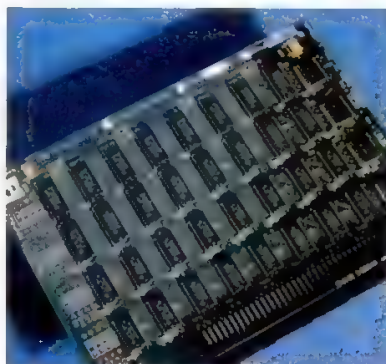
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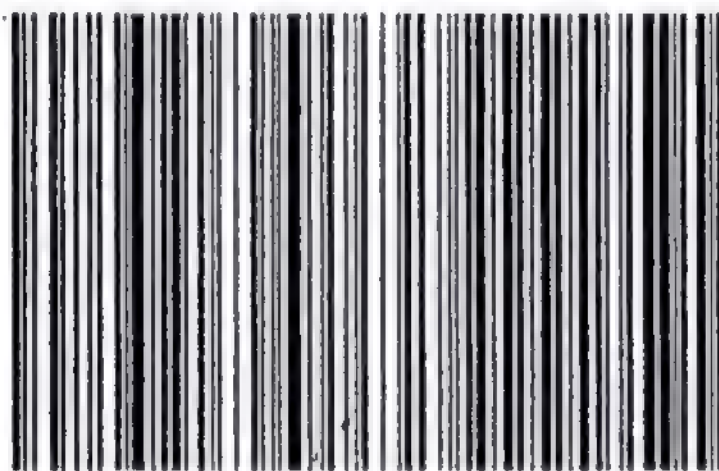
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Environments

BOUNCE.EXE by executing

MAKE BOUNCE.MAK

Or you can download all the source code and BOUNCE.EXE from PC MagNet.

The ball in BOUNCE bounces back and forth in a W pattern within the client area. The background of the client area is white. The ball is red. At any time, the ball can be seen in one of 33 nonoverlapping positions.

This requires 34 palette entries, one for the background and one each for the 33 different positions of the ball. BOUNCE draws 33 balls using 33 different palette index colors. At any time during the animation, one of these palette index colors will map to red and the other 32 to white.

WM_CREATE PROCESSING

Unlike the GRAYS program I discussed two issues ago, BOUNCE needs to know whether the video display device driver supports palette manipulation. The program won't work if it doesn't.

So, BOUNCE.C begins processing of the WM_CREATE message in WndProc

by calling GetDeviceCaps with the RASTERCAPS parameter and checking that the RC_PALETTE flag is set. This check will fail if the device driver doesn't support palette management. BOUNCE will not work with the current 16-color VGA driver.

If the RC_PALETTE flag is set, BOUNCE continues by calling GetDeviceCaps with the SIZEPALETTE and NUMRESERVED parameters. (Recall that for the IBM 8514/A, these values are 256 and 20, respectively.) BOUNCE uses 34 palette entries for its animation, so it checks that the size of the palette minus the number of reserved colors is at least 34. This

BOUNCE.C

1 OF 2

```
/*-----
BOUNCE.C -- Palette Animation Using Windows 3.0 Palette Manager
(c) Charles Petzold, 1996
-----*/

#include <windows.h>

long FAR PASCAL WndProc (HWND, WORD, WORD, LONG) ;

#define ID_TIMER 1

int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
LPSTR lpszCmdLine, int nCmdShow)
{
    char szAppName [] = "Bounce" ;
    HWND hwnd ;
    MSG msg ;
    WNDCLASS wndclass ;

    if (!hPrevInstance)
    {
        wndclass.style = CS_HREDRAW | CS_VREDRAW ;
        wndclass.lpfnWndProc = WndProc ;
        wndclass.cbClsExtra = 0 ;
        wndclass.cbWndExtra = 0 ;
        wndclass.hInstance = hInstance ;
        wndclass.hIcon = NULL ;
        wndclass.hCursor = LoadCursor (NULL, IDC_ARROW) ;
        wndclass.hbrBackground = GetStockObject (WHITE_BRUSH) ;
        wndclass.lpszMenuName = szAppName ;
        wndclass.lpszClassName = szAppName ;

        RegisterClass (&wndclass) ;
    }

    hwnd = CreateWindow (szAppName, "Bounce: Palette Animation",
        WS_OVERLAPPEDWINDOW,
        CW_USEDEFAULT, CW_USEDEFAULT,
        CW_USEDEFAULT, CW_USEDEFAULT,
        NULL, NULL, hInstance, NULL) ;

    ShowWindow (hwnd, nCmdShow) ;
    UpdateWindow (hwnd) ;

    while (GetMessage (&msg, NULL, 0, 0))
    {
        TranslateMessage (&msg) ;
        DispatchMessage (&msg) ;
    }

    return msg.WParam ;
}

long FAR PASCAL WndProc (HWND hwnd, WORD message, WORD wParam, LONG lParam)
{
    static BOOL bLeftToRight = TRUE ;
    static HPALETTE hPal ;
    static LOCALHANDLE hLocalMem ;
    static LOGPALETTE *pPlp ;
    static short cxClient, cyClient, iBall = 0 ;
    static BOOL bPalSupport ;
    static HBRUSH hBrush ;
    static HDC hdc ;
    static int x1, x2, y1, y2 ;
    static long i ;
    static PAINTSTRUCT ps ;
    static RECT rc ;

    switch (message)
    {
        case WM_CREATE:
            // Check for palette support

            hdc = GetDC (hwnd) ;
            bPalSupport = (RC_PALETTE & GetDeviceCaps (hdc, RASTERCAPS)) &&
                (GetDeviceCaps (hdc, SIZEPALETTE) -
                GetDeviceCaps (hdc, NUMRESERVED) > 34) ;

            ReleaseDC (hwnd, hdc) ;

            if (!bPalSupport)
            {
                MessageBox (hwnd, "Program requires palette support",
                    "Bounce", MB_ICONEXCLAMATION | MB_OK) ;

                DestroyWindow (hwnd) ;
                return 0 ;
            }

            // Allocate memory for LOGPALETTE structure and lock it
            hLocalMem = LocalAlloc (LMEM_MOVEABLE, sizeof (LOGPALETTE) +
                33 * sizeof (PALETTEENTRY)) ;

            pPlp = (LOGPALETTE *) LocalLock (hLocalMem) ;

            // Initialize the fields of the LOGPALETTE structure
            pPlp->palVersion = 0x300 ;
            pPlp->palNumEntries = 34 ;

            for (i = 0 ; i < 34 ; i++)
            {
                pPlp->palPalEntry[i].peRed = 255 ;
                pPlp->palPalEntry[i].peGreen = (i == 0 ? 0 : 255) ;
                pPlp->palPalEntry[i].peBlue = (i == 0 ? 0 : 255) ;
                pPlp->palPalEntry[i].peFlags = (i == 33 ? 0 : PC_RESERVED) ;
            }

            // Create the logical palette & unlock the memory block
            hPal = CreatePalette (pPlp) ;
            LocalUnlock (hLocalMem) ;
            // Set the timer for 50 msec

            SetTimer (hwnd, ID_TIMER, 50, NULL) ;
            return 0 ;

        case WM_SIZE:
            cxClient = LOWORD (lParam) ;
            cyClient = HIWORD (lParam) ;
            return 0 ;

        case WM_TIMER:
            pPlp = (LOGPALETTE *) LocalLock (hLocalMem) ;

            // Set old ball color to white
            pPlp->palPalEntry[iBall].peGreen = 255 ;
            pPlp->palPalEntry[iBall].peBlue = 255 ;

            iBall += (bLeftToRight ? 1 : -1) ;

            if (iBall == (bLeftToRight ? 33 : -1))
            {
                iBall = (bLeftToRight ? 31 : 1) ;
                bLeftToRight ^= TRUE ;
            }

            // Set new ball color to red
            pPlp->palPalEntry[iBall].peGreen = 0 ;
            pPlp->palPalEntry[iBall].peBlue = 0 ;

            // Animate the palette
            AnimatePalette (hPal, 0, 33, pPlp->palPalEntry) ;

            LocalUnlock (hLocalMem) ;
```

Figure 4: This listing contains all the source code for the BOUNCE program.

Environments

check is important. In a recent conversation with one of the *Windows* developers at Microsoft, I learned that a version of the 16-color VGA driver that supports

palette management will be released sometime. The size of the palette will be 16, and the driver will probably reserve 8 colors. BOUNCE won't work with this driver either, but in the next issue, I'll show you two palette animation programs that will.

The next step in WM_CREATE proc-

msec. This generates the WM_TIMER messages that BOUNCE uses to change the palette.

DRAWING AND ANIMATING

BOUNCE does all its drawing during the WM_PAINT message. After getting a device context handle, it selects the palette into the device context and realizes it, as usual.

The background of the window is drawn with a solid brush with a color specified by a palette index of 33. The colors of the 33 balls are drawn with colors based on palette indexes ranging from 0 to 32. When BOUNCE first draws on its client area, the palette index of 0 maps to red, and the other palette indexes map to white. This causes the ball to appear in the upper-left corner.

The animation occurs when WndProc processes the WM_TIMER message. The function required is AnimatePalette:

```
AnimatePalette (hPal, wStart, wNum, spe);
```

The first parameter of this function is a handle to the palette, and the last parameter is a pointer to one or more PALETTEENTRY structures arranged as an array. The function alters one or more entries in the logical palette beginning with the wStart entry and continuing for wNum entries. The new wStart entry in the logical palette is taken from the first element in the PALETTEENTRY structure. (Be very careful! The wStart parameter is an index into the original logical palette table, not an index into the PALETTEENTRY array.)

For convenience's sake, BOUNCE uses the array of PALETTEENTRY structures that is part of the LOGPALETTE structure used when creating the logical palette. The current position of the ball (from 0 to 32) is stored as the iBall variable. When processing the WM_TIMER mes-

When initializing the array of PALETTEENTRY structures, BOUNCE sets the first palette entry (corresponding to the position of the ball in the upper-left corner) to red, and the rest of them to white. You should note that the peFlags field is set to PC_RESERVED for all entries except the background (the last palette entry).

BOUNCE.EXE concludes WM_CREATE processing by setting a Windows timer with an interval of 50

BOUNCE.DEF		COMPLETE LISTING
; BOUNCE.DEF module definition file		
NAME	BOUNCE	
DESCRIPTION	'Palette Animation (c) Charles Petsold, 1990'	
EXETYPE	WINDOWS	
STUB	'WINSTUB.EXE'	
CODE	PRELOAD MOVEABLE DISCARDABLE	
DATA	PRELOAD MOVEABLE MULTIPLE	
HEAPSIZE	1924	
STACKSIZE	8192	
EXPORTS	WndProc	

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Figure 5: This is BOUNCE's module-definition file.

BOUNCE.C

2 OF 2

```
return 0 ;

case WM_PAINT:
    hdc = BeginPaint (hwnd, &ps) ;

    SelectPalette (hdc, hPal, FALSE) ;
    RealizePalette (hdc) ;

    // Draw window background using palette index 33
    GetWindowRect (hwnd, &rc) ;
    hbrush = CreateSolidBrush (PALETTEINDEX (33)) ;
    FillRect (hdc, &rc, hbrush) ;
    DeleteObject (hbrush) ;

    SelectObject (hdc, GetStockObject (NULL_PEN)) ;

    // Draw the 33 balls
    for (i = 0 ; i < 33 ; i++)
    {
        x1 = i * cxClient / 33 ;
        x2 = (i + 1) * cxClient / 33 ;
        if (i < 9)
        {
            y1 = i * cyClient / 9 ;
            y2 = (i + 1) * cyClient / 9 ;
        }
        else if (i < 17)
        {
            y1 = (16 - i) * cyClient / 9 ;
            y2 = (17 - i) * cyClient / 9 ;
        }
        else if (i < 25)
        {
            y1 = (i - 16) * cyClient / 9 ;
            y2 = (i - 15) * cyClient / 9 ;
        }
        else
        {
            y1 = (32 - i) * cyClient / 9 ;
            y2 = (33 - i) * cyClient / 9 ;
        }

        hbrush = CreateSolidBrush (PALETTEINDEX (i)) ;
        SelectObject (hdc, hbrush) ;

        Ellipse (hdc, x1, y1, x2, y2) ;

        DeleteObject (SelectObject (hdc,
            GetStockObject (BLACK_BRUSH))) ;
    }

    EndPaint (hwnd, &ps) ;
    return 0 ;

case WM_QUERYNEWPALETTE:
    hdc = GetDC (hwnd) ;

    SelectPalette (hdc, hPal, FALSE) ;

    if (RealizePalette (hdc) > 0)
    {
        ReleaseDC (hwnd, hdc) ;
        InvalidateRect (hwnd, NULL, FALSE) ;
        return TRUE ;
    }
    else
    {
        ReleaseDC (hwnd, hdc) ;
        return FALSE ;
    }
    break ;

case WM_PALETTECHANGED:
    if (wParam != hwnd)
    {
        hdc = GetDC (hwnd) ;

        SelectPalette (hdc, hPal, FALSE) ;

        if (RealizePalette (hdc) > 0)
        {
            InvalidateRect (hwnd, NULL, FALSE) ;
        }

        ReleaseDC (hwnd, hdc) ;
    }
    return 0 ;

case WM_DESTROY:
    KillTimer (hwnd, ID_TIMER) ;
    LocalFree (hLocalMem) ;
    DeleteObject (hPal) ;
    PostQuitMessage (0) ;
    return 0 ;

return DefWindowProc (hwnd, message, wParam, lParam) ;
}
```


Environments

sage, BOUNCE sets that PALETTEENTRY element to white. It then calculates a new position of the ball and sets that element to red. The palette is changed with the call:

```
AnimatePalette (hPal, 0, 33,  
p1p->palPalEntry) ;
```

GDI changes the first 33 logical palette entries (even though only 2 actually change), makes the corresponding changes in the system palette table, and then changes the hardware palette table on the video board. Without any redrawing, the ball appears to move.

OTHER APPROACHES

Although AnimatePalette works very fast, you should probably avoid changing all the logical palette entries when only one or two actually change. This is a little complicated in BOUNCE, because the ball bounces back and forth—iBall is first incremented and then decremented. Another approach would be to have two other variables called iBallOld (set to the previous position of the ball) and iBallMin (the lesser of iBall and iBallOld). You then call AnimatePalette to change just the two entries:

```
iBallMin = min (iBall, iBallOld) ;  
AnimatePalette (hPal, iBallMin, 2,  
p1p->palPalEntry + iBallMin) ;
```

Here's yet another approach: Let's suppose you first define a single PALETTEENTRY structure:

```
PALETTEENTRY pe ;
```

During WM_TIMER processing, you set the PALETTEENTRY fields for white and call AnimatePalette to change one entry at the iBall position in the logical palette:

```
pe.peRed = 255 ;  
pe.peGreen = 255 ;  
pe.peBlue = 255 ;  
pe.peFlags = PC_RESERVED ;
```

```
AnimatePalette (hPal, iBall,  
1, pe) ;
```

You then calculate the new value of

iBall as shown in BOUNCE, define the fields of the PALETTEENTRY structure for red, and call AnimatePalette again:

```
pe.peRed = 255 ;  
pe.peGreen = 0 ;  
pe.peBlue = 0 ;  
pe.peFlags = PC_RESERVED ;
```

```
AnimatePalette (hPal, iBall,  
1, pe) ;
```

MORE TO COME

A bouncing ball is a traditional animation illustration, but it really isn't suited for palette animation, because all of its possible positions must be drawn first. Palette animation is more suited for showing repetitive patterns of movement.

But I'm not yet finished with palette animation. In the next issue, I'll show you two programs that require only one palette entry for animation. ■

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Power Programming

Actor: A Development Environment for Windows Applications

In this issue, we'll return to our examination of high-level application development tools for *Windows*. The next stop on our fitful tour is Actor, a product of the Whitewater Group in Evanston, Illinois. Actor is a full-fledged object-oriented programming language (OOPL) with all of the classic hallmarks of such a language: polymorphism, encapsulation, and inheritance. Unlike ToolBook, the topic of our earlier discussion, Actor is a complex package that can be used effectively only by experienced programmers.

Whence the name *Actor*? In OOP circles, the terms *actor*, *agent*, and *server* are used to describe the relationships between objects. Grady Booch (*Object Oriented Design with Applications*, page 89) defines them as follows: An *actor* is an object that can operate upon other objects but is never operated upon by other objects. In some contexts, the terms *active object* (that is, an object that encompasses its own thread of control) and *actor* are interchangeable. An *agent* is an object that can both operate upon other objects and be operated upon by other objects. A *server* is an object that never operates upon other objects; it is only operated upon by other objects.

The term *actor* is also sometimes used by OOP mavens for a particular category of OOP languages that emphasize delegation of function (as opposed to languages that emphasize concurrency, distributed objects, frame management, and so on).

The key technical figure behind Actor is Charles B. Duff, a prolific programmer, writer, and evangelist of OOP concepts. Duff first appeared on the microcomputer software scene circa 1984 as the author of Neon, an OOPL for the Macintosh. Neon was a conscious attempt to marry FORTH's efficiency and ready access to the hardware, with the best features of Smalltalk. It was quite successful by early Macintosh standards; many of the first Macintosh applications were written in it, and it has loyal adherents even

■ A full-fledged object-oriented programming language that lends itself well to GUI-based application development. Actor nonetheless has some severe limitations.

today—although its publisher, Kriya Systems, no longer supports it. Rumors about the development of a public domain clone of Neon have recently begun to circulate on Usenet.

In 1985 Duff left Kriya Systems and with Mark Achler (another OOP enthusiast) formed the Whitewater Group to develop and sell Actor. Duff writes, "As a company, we placed our first big bet on *Microsoft Windows* in 1985. We hoped that it would eventually provide leadership in what was then a crowded market. Little did we suspect that a joint development agreement between IBM and Microsoft would propel it into the industry standard that it has become."

The first two versions of Actor were widely admired and reviewed, but achieved little acceptance, as a result of the performance problems and severe memory limitations of *Windows*, Versions 1.x and 2.x. But the advent of *Windows* 3.0, with its ability to run applications in protected mode and to use extended memory, makes the development of large, complex applications in Actor a much more viable proposition.

Unlike Neon, Actor is not based on FORTH, although Duff did use an RPN virtual stack machine to bootstrap the initial version of the language, and Actor source code is compiled to a FORTH-like "token-threaded" object code. Actor's parser expects infix notation, and the parser is implemented as a state machine generated with the Unix utility **yacc**. The language's "primitives" appear to be written in a mixture of C and assembly language.

THE ACTOR DEVELOPMENT ENVIRONMENT

The Actor programmer does his work within a multiplicity of windows, each with a special purpose. The Display window is present at all times but serves little useful function other than as a default output frame for the Actor interpreter/compiler's advisory and error messages. The only two menu options on the Display window are Windows (which allows you to bring one of the other active Actor windows to the foreground) and Seal Off (used to convert an Actor program into a turnkey application).

The Workspace window is the heart of the development system. You use this window to enter source code into the system interactively for testing and debugging; invoke the file editor, browser, and inspector tools; force Actor to run its garbage collector; save a snapshot of the Actor executable image; list all the senders or receivers of a particular message; or itemize all the routines that touch a certain variable. The Workspace window is a child of the Display window. It's always visible in front of the Display

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window but never completely obscures it (see Figure 1).

The Browser window (Figure 2) is a specialized editor for the creation and modification of class definitions. It has four panes: a hierarchical or alphabetical list of the system's classes; lists of the variables and methods associated with a selected class; and a large editing area where method code can be entered, displayed, or altered. You can have more than one Browser open at a time, making it easy to cut-and-paste code from one class to another.

The Inspector window (Figure 3) is similar to the Browser, but it's oriented toward examining or editing data rather than code. You can also use this window to trace the relationships among data objects in complex structures. As with the Browser, you can open multiple Inspector windows simultaneously and manipulate them as individual entities.

You use the File Editor window (Figure 4) to create, alter, and display ordinary ASCII files. It includes full facilities for merging of existing files, cutting, copying, pasting, searching, and replacing source code or any other text. A particularly nice feature of the File Editor is that it is implemented as a visible class and can be subclassed by the Actor programmer to build customized text editors for applications. Again, multiple File Editor windows can be used at once, and they can be independently moved, resized, or minimized to icons.

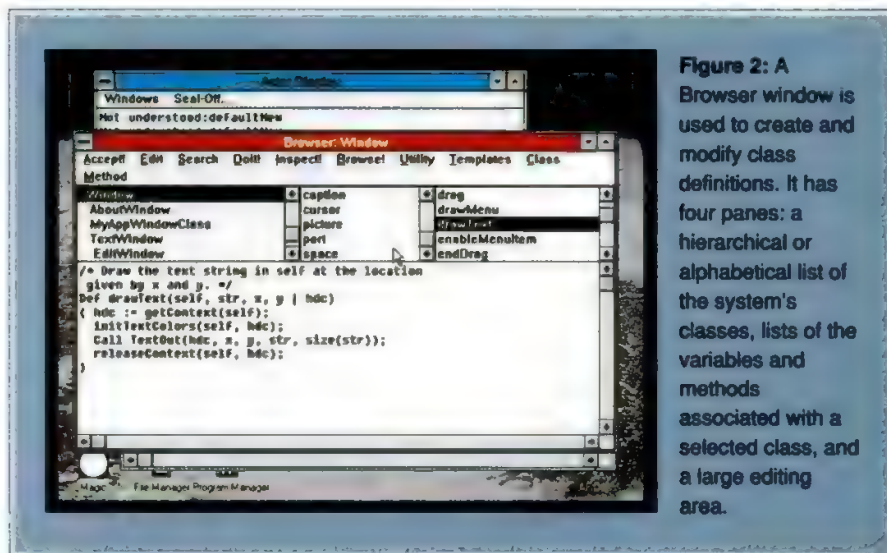


Figure 2: A Browser window is used to create and modify class definitions. It has four panes: a hierarchical or alphabetical list of the system's classes, lists of the variables and methods associated with a selected class, and a large editing area.

The Debugger window (Figure 5) combines many aspects of both the Browser and Inspector windows. A Debugger window appears automatically whenever the Actor runtime system detects an error, displaying a "walkback" list of the messages, senders, and receivers that led to the error. There is also a special key combination that can be used to activate the Debugger asynchronously while an application is running. You can use the Debugger to inspect or alter code, change the values of variables, and resume execution of the failing program after a fix has been applied.

Needless to say, with all these different types of windows floating around (not to mention any additional windows that are created by the application program under development), the screen of an ordinary VGA display soon becomes frighteningly

cluttered and difficult to read. So, in the interests of increased productivity and decreased eyestrain, the serious Actor programmer should insist on the biggest, fastest graphics display that his company can afford.

THE ACTOR LANGUAGE

Unlike the Actor development environment, which is clearly a direct offspring of Smalltalk, the Actor programming language is a bizarre amalgam of Smalltalk, C, Pascal, QuickBASIC, FORTH, and (for all I know) a host of other influences I was too ignorant to detect. Actor comments are cloned from C:

```
/* this is a comment */
```

Actor assignment statements resemble Pascal:

```
foo := bar
```

Actor references to arrays and structures look sometimes like Smalltalk and sometimes like C:

```
#(1 2 3 4)
```

```
MyArray[0]
```

Actor control structures appear to be the offspring of a Cuisinart session with QuickBasic, C, Pascal, and FORTH. For example, we have

```
if <condition>
then <statements>;
else <statements>;
endif;
```

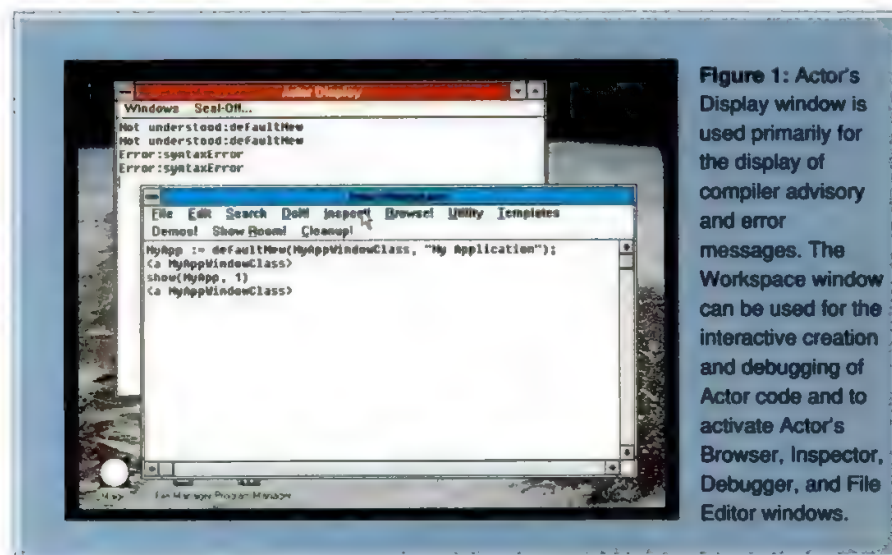


Figure 1: Actor's Display window is used primarily for the display of compiler advisory and error messages. The Workspace window can be used for the interactive creation and debugging of Actor code and to activate Actor's Browser, Inspector, Debugger, and File Editor windows.

Power Programming

and we also have

```
select
  case <condition>
  is <statements>;
endCase
case <condition>
  is <statements>;
endCase;
...
<default statements>;
endSelect;
```

and of course, the ever-popular

```
loop <statements>;
while <condition>
begin <statements>;
endLoop;
```

There are also **do**, **collect**, and **extract** control constructs that will feel vaguely familiar to any programmer with an eclectic-enough background.

The veteran C programmer is most likely to get into trouble when learning Actor, because Actor syntax that appears congruent to C frequently has a radically different meaning. For example, the statement

```
print(fred, 1);
```

is perfectly valid in either C or Actor. In C, this statement means "call the proce-

dure named print, passing the arguments fred and 1." In Actor, it means "send the message named print to the object named fred, passing the argument 1." Having worked with both Smalltalk and C, I found this counterintuitive Actor notation very disturbing.

Actor comes with a large and elaborate class library, which in turn contains Actor's methods for dealing with windows, controls, files, strings, printing, and so on. These classes have roughly the same relationship to the Actor language as the C runtime library has to the C language; the compiler doesn't really know anything about them except how to generate "calls" to their instantiations, but the language would be useless without them. Most of the classes are precompiled in Actor's start-up "image" and are also supplied in source code form.

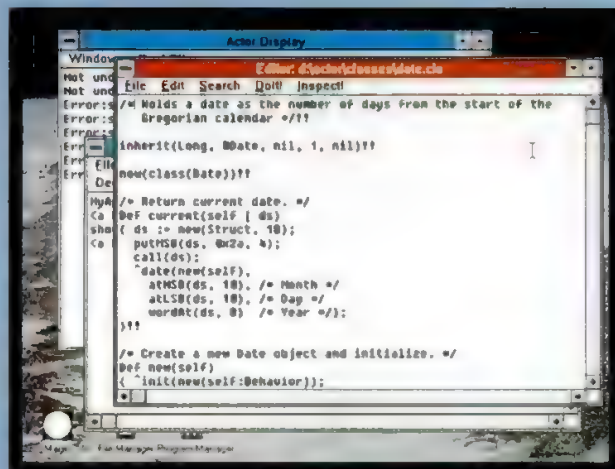


Figure 4: A File Editor window is used to create, alter, and display ordinary ASCII files. It includes full facilities for merging of existing files, cutting, copying, pasting, searching, and replacing source code or any other text.

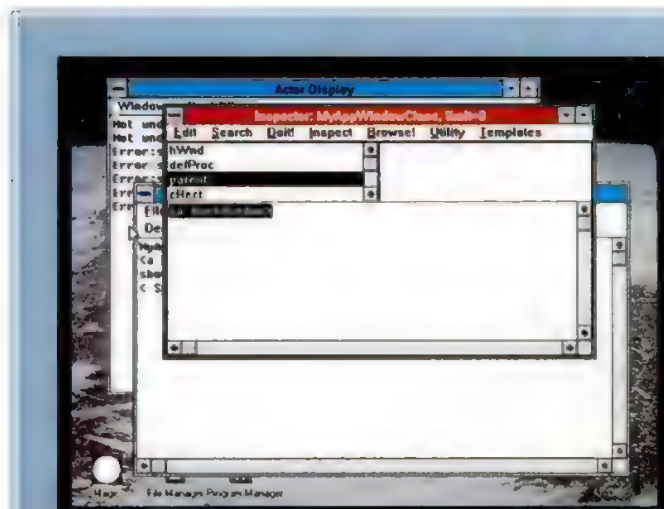


Figure 3: An Inspector window is similar to a Browser window, but it is oriented toward the examination or editing of data rather than of "methods" (code).

Unfortunately, Actor's class hierarchy bears only a passing resemblance to the hierarchies of other object-oriented programming tools for GUI environments. Comparing Actor with Smalltalk/V, for example, we find that there is barely any similarity between the two class trees, even in such fundamental areas as collections and files. It's really sad that OOPs are being billed as the magic answer to the complexity of GUI environments, yet the OOP vendors haven't gotten together and agreed on fundamental class hierarchies for controlling those environments. Imagine what it would be like to program in C if every compiler vendor dreamed up his own runtime library!

THE DOCUMENTATION

The Actor documentation is divided into two perfectly bound softcover volumes, totalling about 1,200 pages. The first volume is tutorial in nature—it reviews basic object-oriented programming concepts, walks the user through the fundamental elements of an Actor application using several example programs, and then discusses the core Actor classes, data structures, file management, windowing, graphics, dialogs, menus, controls, and printing in individual in-depth chapters.

The second volume is a detailed reference manual to the Actor language, classes, debugger, and error messages. It also contains a synopsis of the Windows API and messages, and instructions for the integration of C or assembly language routines into an Actor program. Once a programmer has become skilled with the Actor language, he will rarely bother to look at the first tutorial volume, while the second volume

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will remain indispensable.

There's little more to say about the Actor manuals except that they rank among the very best documentation I've seen for a personal computer programming tool. The manuals are clearly written, carefully edited, well-organized, skillfully designed, beautifully produced, and exhaustively indexed. Contradictions, errors, and misspellings are somewhere between extremely rare and nonexistent.

THE PROS AND CONS

As a programming language for *Windows*, Actor has some powerful assets. It's a true object-oriented programming language that lends itself well to implementing a classical GUI-based application. It's a solid, well-supported, well-documented product that has evolved through three major versions in parallel with the *Windows* environment. The Whitewater Group has managed to keep the faith and stay the course through the *Windows* dog days, and it now seems poised to cash in on the startling success of *Windows* 3.0 and the ensuing retargeting of application developers.

But there are several aspects of Actor that should make programmers think twice before launching into any serious, large-scale development efforts. First, Actor is a single-source, single-platform, somewhat idiosyncratic programming language. If the Whitewater Group should suddenly go belly-up, you'd find yourself dependent on a unique programming tool with no hope of updates as future versions of *Windows* appear, and you'd have to face the prospect of a painful conversion to another object-oriented programming language. On the other hand, should your application be wondrously successful, you'd have no obvious way to migrate the code onto other GUI platforms such as OS/2 or the Macintosh. Similarly, if you find yourself in need of additional programmers, your chances of locating experienced Actor coders are dismal, and you'd need to factor in a lengthy learning curve for other team members.

Second, even when running in *Windows*' 386 enhanced mode with several megabytes of RAM, I found Actor 3.0's performance as a development environment quite disappointing. Compilation of a chunk of method code only four or five lines

long can take 30 seconds or more, and clicking "Clean Up!" to request garbage collection after the briefest session of interactive coding and testing can cause the infamous hourglass icon to appear for three or four minutes. These delays severely limit the usefulness of Actor's interpreter and incremental compiler, and

Actor is a true object-oriented programming language that lends itself well to implementing a classical GUI-based application.

they dissipate one of Actor's major advantages compared with traditionally compiled object-oriented languages such as C++.

Finally, Actor simply doesn't do an adequate job of hiding the complexities and perplexities of *Windows* from the programmer. Your first clue to this weakness comes when you're asked to tell Actor how much memory to allocate for dynamic and static objects—values that Actor certainly ought to be able to adjust for itself in a protected-mode environment. Although some operations, such as

the creation and maintenance of display windows, are made simple and natural by Actor, other common tasks (such as tracking the mouse) are supported by Actor at such a primitive level that there's really no advantage over writing the code in C. Further, when it comes to the creation and incorporation of static dialog boxes, icons, and menus, Actor offers no facilities of its own at all; you need to fall back on the generic *Windows* reference manuals and on arcane, clumsy Microsoft tools such as the Resource Compiler.

For example, let's look at what's involved in building a so-called turnkey application written in Actor—a matched set of executable and "image" files that can be distributed to end users without a royalty or license fee. You'd think, since Actor is after all a tool oriented specifically to application programmers, that this process would be simple and painless. But Actor requires you to follow a long, annoying, and trouble-prone sequence of steps that includes invoking the Seal Off dialog and specifying the amount of dynamic and static memory that will be used by the application (pure guesswork), dropping out of Actor to DOS, using the COPY command three times, modifying a template resource file with a text editor, and running the Microsoft Resource Compiler to build a modified .EXE file from the original ACTOR.EXE. If Actor were a properly polished product, these steps would all be smoothly and invisibly performed within the Actor environment. The final turnkey applications don't win any prizes for leanness, either—a simple Actor program that does nothing more than allow the user to scribble in a window with the

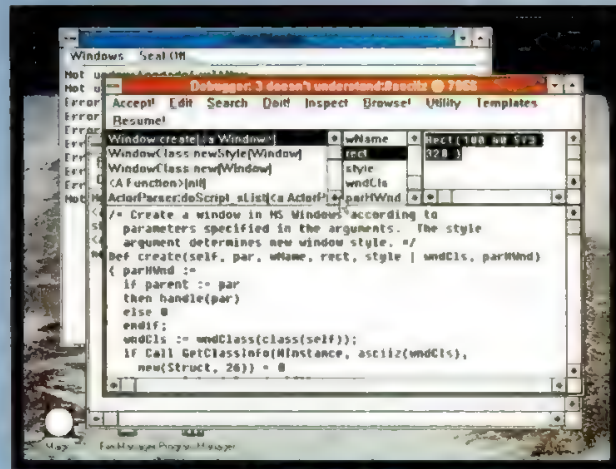


Figure 5: The Debugger window combines many aspects of both the Browser and Inspector windows. A Debugger window appears automatically whenever the Actor runtime system detects an error, or it can be activated with a special key combination.

Power Programming

mouse requires over 300K of disk space.

After playing with Actor for several months, I've concluded that it's a technically impressive implementation of a rather bad idea. The world does not need yet another OOPL or another complex class hierarchy; what it does need is improvement and standardization of the mainstream OOPLs that already exist. It's a crying shame that the considerable tal-

What's really needed
is improvement and
standardization of the
mainstream OOPLs
that already exist.

ents of Duff and his colleagues were not turned toward giving ParcPlace Systems a run for their money with a *Windows*-based, token-threaded implementation of Smalltalk, or toward providing Borland with some formidable competition by pioneering a *Windows*-based, incrementally compiled version of C++.

FURTHER READING

- "Designing an Efficient Language," by Charles Duff. *Byte*, August 1986, page 211.
- "Development of a Threaded Object-Oriented Language," by Charles Duff. *Journal of Forth Application and Research*, Volume 4, Number 2, 1986, page 155.
- "Forth Meets Smalltalk," by Charles Duff and Norman Iverson. *Journal of Forth Application and Research*, Volume 2, Number 3, 1984, page 7.
- "Migration Patterns," by Charles Duff and Bob Howard. *Byte*, October 1990, page 223.

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by
William S. Hall

Windows

QEMM AND WINDOWS

I use Quarterdeck Office Systems' memory manager, *QEMM*, to run some programs in memory between 640K and 1MB. The conventional memory this frees lets me load bigger programs than I could otherwise. I wanted to give the same memory bonus to applications running under *Windows*, but *Windows* didn't like *QEMM*. Any suggestions?

James Dutton
Boston, Massachusetts



Quarterdeck Office Systems recently updated its popular product, and *Windows* likes *QEMM* much more now than it used to. *QEMM-386*, Version 5.1, still delivers the memory bonus you spoke of, but now it also provides what *Windows* requires in memory management services *and*—another bonus—it's compatible with all *Windows* 3.0 modes. We'll take a good look at *QEMM*, but first let's glance at a helpful concept and the term describing it to keep us out of the jargon jungle later.

The part of memory from 640K to 1MB is reserved for use by video display adapters and the BIOS, but some blocks of it normally remain free. Microsoft calls the unused chunks Upper Memory Blocks (UMBs).

Memory managers like *QEMM* relocate or *map* extended memory into UMBs, then move device drivers, DOS resources (buffers, files, and so on), and TSRs from conventional memory to upper memory. This results in greater conventional memory available for DOS programs. These recovered bytes can more than offset the extra bites *Windows* chews out of your scarce memory as a penalty for running lowly DOS programs—overhead that's often just enough to prevent an application from loading and executing.

QEMM's ability to load programs into UMBs can tame problematic configurations involving networks and *Windows*. For example, if I install the *Windows*-supplied drivers HIMEM, SmartDrive,

■ **QEMM AND WINDOWS:**
Using upper memory with
QEMM-386 to polish
Windows' memory
performance.

EMM386, and RAMDrive, I have about 570K of conventional memory available. If I run *Windows* in 386 mode and start a DOS shell, I'm left with 553K, still enough to execute any of the DOS programs I normally use. But with network drivers loaded, free memory plunges to 450K. That's too little to run Microsoft's C Compiler—the program I use most—from *Windows*. When compiling even moderate-size programs inside *Windows*, I'll frequently run out of symbol-table space if available memory drops below 500K.

Installing *QEMM*, however, gives me 603K of memory before loading the network and 566K after. Even with the extra 17K of overhead introduced by *Windows*, the 548K of memory remaining in a shell executed from *Windows* suffices for all my DOS tasks.

As a *Windows* user, you substitute *QEMM-386* for HIMEM.SYS and EMM386.SYS. HIMEM is the *Windows*-supplied arbiter of extended memory. *Windows* can't run in either standard or enhanced mode without an extended memory (XMS) manager such as HIMEM.

EMM386.SYS is a *Windows*-compatible device driver that emulates expanded (EMS) memory in extended memory. You should install this driver *only* if you need expanded memory outside of *Windows* for DOS applications or if you run real-mode *Windows* and want to take advantage of its ability to use both large- and small-frame EMS. (Enhanced-mode *Windows* automatically supplies EMS for both *Windows* and DOS applications run from *Windows* whether EMM386 is installed or not.)

The new version of *QEMM-386* can supply *Windows*-compatible XMS and EMS support. *QEMM* requires less memory than HIMEM and has only about one-fifth the overhead of HIMEM *and* EMM386 combined. Memory can be used as either XMS or EMS, without any special configuration parameters and is parceled out on demand. EMM386, in contrast, requires you to specify how much expanded memory you want. *QEMM* even lets you prevent *Windows* from seizing control of all extended memory by limiting the amount *Windows* believes to be unused. This way, programs that allocate memory through the Virtual Control Program Interface (VCPI) can find memory available while *Windows* is running in standard mode. As a consequence, it's possible to use software such as *Paradox 386*, *AutoCAD 386*, or *IBM Interleaf* within *Windows* in standard mode. You won't be able to use these programs in *Windows* enhanced mode, however. They contain DOS extenders that conflict with enhanced-mode task management.

Installing and using *QEMM-386* with *Windows* in place is straightforward. Optimizing its use, however, can require a little effort, although Quarterdeck supplies some excellent tools to help you. Before you begin, you may want to make sure that your AUTOEXEC.BAT and CONFIG.SYS files are arranged just the way you want. For example, does your AUTOEXEC call other batch files to load TSRs? If so, *QEMM* can't perform a complete optimization, and you'll want to integrate the functions those other batch routines provide into your AUTOEXEC.BAT. This sort of consolidation can be especially tedious in a network environment, since fairly complex batch files often direct the loading of network modules. The extra effort pays big rewards in recovered memory, though.

QEMM requires certain changes in CONFIG.SYS, and you'll want to make others for the performance boost they'll inject. There's strength in small numbers

Windows

now like FILES=10 and BUFFERS=1 or similar miserly values. Use *QEMM*'s FILES.COM and BUFFERS.COM in your AUTOEXEC to allocate whatever additional amounts you need. Make them the *top* lines, though, because system response will be slower until they load. Under MS-DOS 3.3 or later, add the line STACKS=0,0 in CONFIG.SYS to save the couple of thousand bytes taken by the default setting of 9,192. Reduce your LASTDRIVE parameter to reflect the actual number of drives on your system. If you're using network drives, replace the LASTDRIVE parameter with *QEMM*'s LASTDRIV.COM to allocate the necessary RAM in a UMB. If you install SmartDrive, reduce your buffers to 10. Remove or comment out

any references you may have to EMM386.SYS and HIMEM.SYS. You can place a REM statement at the beginning of the line, although it will produce an error message (which you can ignore) at boot time in DOS versions below 4.0.

If you have reason to exclude any regions of memory, you should do it now. My network board, for example, needs a 16K memory window beginning at DC000h whenever the network is loaded. To tailor my CONFIG.SYS accordingly, I insert the following line:

```
device=QEMM386.SYS RAM  
ADAPTERRAM=DC00-DCFF
```

which specifies that the 16K block of memory starting at DC000h should be excluded from *QEMM*'s control.

In your AUTOEXEC.BAT file, load TSRs before setting environment vari-

ables such as the path, temporary drives, locations of libraries, and the like. DOS gives each program it loads a complete copy of the environment, which goes away when the program does—but TSRs *stay resident* and only some deallocate their environment blocks. Basically, this means the smaller the environment, the less memory lost. The savings can come to a few hundred bytes per TSR. You may need some environment variables of course, (particularly the path) to make a given TSR load and run properly, so a little experimentation may be required.

Now, run the *QEMM-386* installation program. You'll be given the opportunity to specify a number of parameters, but unless you know *exactly* what you're doing, accept the suggested defaults. When done, you'll find a device line loading *QEMM* at the top of CONFIG.SYS

Now you're ready to run *QEMM*'s

```
UNMODIFIED SYSTEM FILES

*** CONFIG.SYS without QEMM ***

shell=\DOS3\command.com c:\dos3 /p /e:512
lastdrive=k
files=40
buffers=10
break=on
stacks=0,0
device=C:\WINDOWS\HIMEM.SYS
device=C:\windows\emm386.sys 2048
device=C:\WINDOWS\SMARTDRV.SYS 2048 1024
device=C:\WINDOWS\RAMDRIVE.SYS 1024 /E
device=C:\SYS\RSYS\OX.SYS

*** AUTOEXEC.BAT without QEMM ***

c:\etc\r\capcon
path=C:\WINDOWS;f:\qemm; ...

echo off
echo INSTALL NETWORK? (1=yes)

get key
if not errorlevel == 1 goto nonet
if errorlevel == 2 goto nonet
.
.
.
C:\xln\tcp\driver
c:\xln\bin\netbios
.
.
.
:nonet
echo on
prompt $p$g
.
.
.
```

Figure 1: These are the original system files, CONFIG.SYS and AUTOEXEC.BAT. *QEMM*'s installation program saves them with extensions of .QDK before making its changes.

```
SYSTEM FILES MODIFIED BY QEMM

*** CONFIG.SYS with QEMM ***

DEVICE=F:\QEMM\QEMM386.SYS RAM ADAPTERRAM=DC00-DCFF
shell=\DOS3\command.com c:\dos3 /p /e:512
lastdrive=h
files=10
buffers=1
break=on
stacks=0,0
device=F:\QEMM\LOADHI.SYS /R:1 C:\WINDOWS\SMARTDRV.SYS 2048 1024
device=F:\QEMM\LOADHI.SYS /R:1 C:\WINDOWS\RAMDRIVE.SYS 1024 /E
device=F:\QEMM\LOADHI.SYS /R:2 C:\SYS\RSYS\OX.SYS

*** AUTOEXEC.BAT with QEMM ***

f:\qemm\loadhi /r:1 f:\qemm\buffers=10
f:\qemm\loadhi /r:2 c:\etc\r\capcon

path=C:\WINDOWS;f:\qemm; ...

echo off
echo INSTALL NETWORK? (1=yes)
get key
if not errorlevel == 1 goto nonet
if errorlevel == 2 goto nonet
.
.
.
f:\qemm\loadhi /r:1 C:\xln\tcp\driver
f:\qemm\loadhi /r:1 c:\xln\bin\netbios
.
.
.
:nonet
echo on
f:\qemm\loadhi lastdrive=k
f:\qemm\loadhi files=40

prompt $p$g
.
.
.
```

Figure 2: This shows the system files after modification by *QEMM*.

Windows

OPTIMIZE program. OPTIMIZE will boot your machine several times in order to determine the best combination of TSRs, device drivers, and DOS resources to be loaded into UMBs and conventional memory. When it's done, you'll have a machine with a significant amount of conventional memory recovered and the capacity to run *Windows* in any mode you want. One footnote—OPTIMIZE generally runs quickly but *occasionally* it really tests the adage "Patience is a virtue." Basically, it tries every possible loading order of TSRs, drivers, and the like, so if you have a bunch, be prepared for a wait.

After you've installed *QEMM*, look at how it modified your AUTOEXEC.BAT and CONFIG.SYS files, but don't panic. You'll find your old ones renamed AUTOEXEC.QDK and CONFIG.QDK.

Figures 1 and 2 are simplified "before and after" pictures of my files. In particular, note the calls to LOADHI, which performs the task of placing a driver, TSR, or DOS resource into the UMB area.

QEMM-386 has a companion program

called *Quarterdeck Manifest* (MFT). MFT is quite useful for analyzing many aspects of your machine. You'll be especially interested in the First Meg command, which shows the layout of both conventional memory and the UMB region. You may find clues to help further improve upper memory utilization. In particular, look for ways to make fragmented memory regions contiguous, in order to load more and larger programs into the UMB area.

The memory area of my network card for example, was originally set to create its window between CC000h and CFFF0h. With the VGA adapter using the region from C0000h to C6000h, only about 24K of contiguous memory was available between the video and network adapters. Following the network memory was an empty 64K segment. On the other hand, the EMS page frame was located at E0000h. By simply reconfiguring the network to use the 16K beginning at DC000h, and thus end where the EMS page frame began, I created an 88K contiguous region of high memory extending from C6000h to DC000h. As a result, I was able to load one additional program into the UMB area and now all of my network resident programs live there happily.

What's the dark side to using *QEMM*? You gain conventional memory, but it comes from your pool of extended memory. *QEMM* requires about 132K on my system. Conventional memory holds far greater value, though, because of its limited expandability and because even a few lost kilobytes can seriously hinder running large DOS programs, especially from *Windows*.

You'll possibly encounter minor quirks like I did on my Zenith Z-386, which now requires two steps to warm boot. *QEMM* maps the ROM area to RAM, then steals an unused portion for loading TSRs, so I receive an incorrect ROM checksum message whenever I perform a warm boot with Ctrl-Alt-Del. However, once acknowledged by a press of the Esc key, the reboot proceeds normally. You may notice similar but generally harmless glitches on your computer.

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by
Sal Ricciardi

Databases

CHECKING FOR LEAP YEARS

I have just received a copy of *Clipper 5.0*. Included with this database package is a collection of source code samples, which the standard installation process places in the \CLIPPER5\SOURCE\SAMPLE\ directory.

I've found that one of them, *DATE.PRG*, contains a leap year-testing function that's invalid. Here's the code supplied by Nantucket Corp.:

```
/*  
* DateIsLeap( <dDate> ) --> lLeap  
* Determine if the year of a  
* supplied date is a leap year  
*/  
FUNCTION DateIsLeap( dDate )  
    RETURN (YEAR( dDate ) % 4) = 0;  
    .AND. .NOT. ((YEAR( dDate );  
    % 400) = 0)
```

Execute this function, and you'll find that 1700, 1800, and 1900 are leap years, while 2000 is not. Actually, just the opposite is true.

Fortunately, *Clipper's* CTOD() function correctly recognizes "2/29/2000" as valid and "2/29/1900" as invalid. Since this is true for both *Clipper 5.0* and *Clipper Summer 87*, a more accurate leap year test is simply to return .T. if 2/29 is a valid date for the given year, and .F. if it is not:

```
FUNCTION IsLeap  
PARAMETER D  
  
RETURN !EMPTY(CTOD("02/29/" +  
ALLTRIM(STR(YEAR(D)))))
```

This syntax will work with either the 5.0 or with the Summer 87 version. Use LEAPTST.PRG (shown in Figure 1) to try out IsLeap.

As you may know, Julius Caesar is credited with the establishment of the leap year. In 45 B.C. he or his advisers determined that our annual trip around the sun was 365 and one quarter days.

Over 1,600 years later, astronomers

■ **CHECKING FOR LEAP YEARS:** Here's a function for validating leap years in *Clipper* and *dBASE*.

■ **DISPLAYING .DBF STRUCTURES:** If you're a *Clipper* user and you forget the name or size of a field, *STRU.PRG* will help.

and mathematicians convinced Pope Gregory XIII that the journey was more like 365 days, 5 hours, 48 minutes, and (almost) 48 seconds. This slight difference in time amounts to 10 days over the course of 16 centuries, and thus the Pope decreed that the date following 10/4/1582 was to be 10/15/1582.

In addition, the new Gregorian Calendar revised the leap year rule and dropped 2/29

from years ending in 00. This still left a small margin of error, however. So an exception to the exception was included, which stated that years evenly divisible by 400 would indeed be leap years. (Still, this formula is off by about 1 day every 3,000 years.)

Only once (on the date 2/29/1600) has the 400-year exception been invoked. It will happen again in a little over 9 years from now and I'd like my programs to be able to handle it!

Robert C. Ashcraft
Christiansburg, Virginia



Only the earliest *Clipper 5.0* releases contained the erroneous function shown above. Nantucket has since corrected the bug, and a working version of *DateIsLeap* is included in currently shipping copies of 5.0.

Mr. Ashcraft's use of February 29 to test for leap-year validity is effective and easily ported to *FoxPro* or *FoxBASE Plus*. It relies on the fact that *Clipper 5.0*, *Clipper Summer 87*, *FoxPro*, and *FoxBASE*

LEAPTST.PRG

COMPLETE LISTING

```
* LEAPTST.PRG, by Robert C. Ashcraft  
* Demonstrates use of ISLEAP() Function  
* Clipper 5.0 and Clipper Summer 87 tested.  
CLEAR  
? "Enter a YEAR (Between 100 - 2999) ..."  
? "(Press ENTER alone to Exit)"  
?  
DO WHILE .T.  
    ACCEPT ">" TO mt  
    IF EMPTY(mt)  
        RETURN  
   ENDIF  
    IF VAL(mt)>99 .AND. VAL(mt)<3000  
        ?? ">",mt,"is" +  
        IIF(IsLeap(CTOD("01/01/"+mt)),""," NOT"),"a Leap Year."  
    ENDIF  
ENDDO  
*  
* FUNCTION IsLeap(date)  
* Return .T. if date is in a leap year, .F. if not  
*  
FUNCTION IsLeap  
PARAMETERS md  
RETURN !EMPTY(CTOD("02/29/" + ALLTRIM(STR(YEAR(md)))))  
* EOF
```



Figure 1: This test program contains the IsLeap function to check whether a date falls within a leap year in *Clipper 5.0* and *Clipper Summer 87*.

Databases

DBLEAP.PRG

COMPLETE LISTING

```

* DBLEAP.PRG
* Version of LEAPTST.PRG to demonstrate use of dBASE ISLEAP() Function
* dBASE IV 1.1 tested.

CLEAR
? "Enter a YEAR (Between 100 - 2999)..."
? "(Press ENTER alone to Exit)"
?
DO WHILE .T.
  ACCEPT ">" TO mt
  IF ""=TRIM(mt)
    RETURN
 ENDIF
  IF VAL(mt)>99 .AND. VAL(mt)<3000
    ?? ">",mt," is ",
    IIF(IsLeap(CTOD("01/01/"+mt)),""," NOT")," a Leap Year."
  ENDIF
ENDDO

* FUNCTION IsLeap(date)
* Return .T. if date is
* in a leap year, .F. if not
* dBASE IV only version
FUNCTION IsLeap
PARAMETER D
PRIVATE Y
Y = TRIM(STR(YEAR(D)))
RETURN ;
( CTOD("02/29/"+Y) < CTOD("03/01/"+Y) )

```

PC MAGNET

Figure 2: This test program contains the IsLeap function to check whether a date falls within a leap year in dBASE IV.

Plus all return an empty date when an invalid date string such as "02/29/90" is passed to CTOD(). This causes the EMPTY function to return .T. in the IsLeap function, which then returns .F. to the caller. If the CTOD() function doesn't return a

null date, then 02/29 is valid, and the year is indeed a leap year (EMPTY will return .F. and IsLeap will return .T.).

You should note that if you're using Ashton-Tate's dBASE, you can't use this technique. Unfortunately, as was shown in

the February 12, 1991, Databases column ("Validating Date Strings"), both dBASE III Plus and dBASE IV automatically convert dates to an internal format and perform some implied arithmetic without any date validity checks. So, for example, CTOD("02/29/90") in dBASE returns the date 03/01/90. This would not work in the IsLeap function that's shown above, so a different technique is needed for dBASE III users.

We can rely on dBASE's converting 02/29 to 03/01 in years that are not leap years and construct a dBASE IV-only function as follows:

```

* FUNCTION IsLeap(date)
* Return .T. if date is
* in a leap year, .F. if not
* dBASE IV only version
FUNCTION IsLeap
PARAMETER D
PRIVATE Y
Y = TRIM(STR(YEAR(D)))
RETURN ;
( CTOD("02/29/"+Y) < ;
  CTOD("03/01/"+Y) )

```

This will return .T. only for years in which dBASE considers "02/29" really to be 02/29. The program in Figure 2 is a version of LEAPTST.PRG that uses the dBASE version of IsLeap.

DISPLAYING .DBF STRUCTURES

When developing procedures for a new database, I often find myself forgetting what I named a field or how much space I allowed the field to occupy. Since I work mostly with Clipper, I need to either call DBU.EXE or use dBASE in order to list the structure. To save myself time I wrote STRU.PRG (shown in Figure 3) to list the structure of a database file.

STRU will list the structure to the screen or create a text file that can be read into my editor, thus saving me from retyping field names when using them in a program.

Steven D. Boemler
Barnhart, Missouri

If you're using Clipper, this may come in handy for displaying .DBF structures from the DOS prompt—such as after you shell to DOS from your word processor. Indeed, Nantucket really should include a similar command line utility with the Clipper product itself.

Since Clipper doesn't have dBASE's DISPLAY STRUCTURE and LIST

STRU.PRG

1 of 2

```

* STRU.PRG list structure of database to screen or
* to a text file.
*
PARAMETERS param1, param2
CLEAR SCREEN
IF TYPE("param1") <> "C"
  param1 = ""
  ? "SYNTAX: STRU <dbf filename> {output filename}"
  QUIT
ENDIF
IF TYPE("param2") <> "C"
  param2 = ""
ENDIF
IF "" $ param1
  param1 = SUBSTR(param1,1,AT(".",param1)-1)
ENDIF
IF .NOT. FILE(param1+".dbf")
  ? "DATABASE FILE "+param1+" NOT FOUND"
  QUIT
ENDIF
USE &param1
COPY TO temp STRUCTURE EXTENDED
USE temp
LIST field_name,field_type,field_len,field_dec TO FILE temp1234.xx1
? ""
? ""

```

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Figure 3: This program will LIST the structure of a Clipper .DBF file to the screen or to a file when run from the DOS prompt.

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Databases

STRUCTURE commands, Mr. Boemler had to resort to creating a temporary database to hold the .DBF's structure using the command

STRU.PRG

2 of 2

```
IF LEN(param2) > 0
IF FILE(param2)
STORE SPACE(1) TO choice
loc = ROW()
@ loc,00 SAY param2 + ;
* Is About To Be OVERWRITTE .... Append.. R)ename.. F)ORGET...
@ loc,COL() GET choice PICTURE "!" VALID choice = "A" .OR. ;
choice = "R" .OR. choice = "F"
READ
IF choice = "A"
? ""
RUN COPY &param2+temp1234.xx1 &param2 >nul
ERASE temp1234.xx1
ENDIF
IF choice = "R"
STORE SPACE(12) TO fname
? ""
? ""
@ loc+2,00 SAY "ENTER A NEW VALID FILENAME..." GET ;
fname PICTURE "!!!!!!!"
READ
RENAME temp1234.xx1 TO &fname
ENDIF
ELSE
RENAME temp1234.xx1 TO &param2
ENDIF
ELSE
RUN del temp1234.x* >nul
ENDIF
CLOSE ALL
ERASE temp.dbf
RETURN
```

COPY TO temp
STRUCTURE EXTENDED

Just one caution: the temporary database is called TEMP.DBF, and a temporary file named TEMP1234.XX1 is also used—make sure you don't have any files with the same name or they will be overwritten.

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Sal Ricciardi is a New York-based consultant and a frequent contributor to PC Magazine.

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by
Craig Stinson

Spreadsheets

FILE OPEN DIALOG BOX REVISITED

I want to make amends for an oversight in the February 12, 1991, column. That column included a macro sent in by Christopher L. Stacy that used *Excel's* SEND.KEYS() function to change the File Open command's default file specification from *.XL to *.XLW. There's no doubt that the SEND.KEYS() function can do the job, but I neglected to point out that there's a much easier alternative.

The single macro statement

```
=OPEN? ("*.XLW")
```

accomplishes the same thing as the following SEND.KEYS statements:

```
=SEND.KEYS ("%fo")  
=SEND.KEYS ("*.XLW")  
=SEND.KEYS ("(enter)")
```

You can also use this formulation in order to substitute any other default in the File Open dialog box.

■ **FILE OPEN DIALOG BOX REVISITED:** A few issues back, we told you how to customize the file spec. Here's an alternative way.

■ **ADDING COLOR TO 1-2-3, RELEASE 2.2:** If you have an EGA or VGA monitor, you can easily liven up the Lotus palette.

ADDING COLOR TO 1-2-3

I've never been fond of the standard *Lotus 1-2-3* EGA/VGA screen colors. After some experimentation, I've discovered that I can change this drab palette, using DEBUG to modify the 123.SET file.

Search for the following sequence of hexadecimal values:

```
00 01 02 03 04 05 06 07 08 09 0A  
0B 0C 0D 0E 1F 00
```

The exact position of that sequence in 123.SET seems to depend on how you've set up your spreadsheet, but in all cases it seems to occur about 81 bytes before the word COMPAQ (in all capital letters).

The first and eighth bytes in this sequence specify background and foreground colors, respectively. The row-and-column frame is set by the fourth byte, while the 17th byte determines the color of the screen border. The frame, cell pointer, and various system indicators (including MODE) are all the same color. To change the color of a screen element, just substitute a different value at the appropriate place in the sequence and then resave your 123.SET file.

Each byte can have a hexadecimal value ranging from 00h (black) to 3Fh (intense white). You can learn what numbers correspond to what colors by consulting either a DOS or a programming manual or simply by experimenting.

The default colors of the four elements mentioned above are black (00h, as noted) for the background and border, cyan (03h) for the frame, and pale white (07h) for the

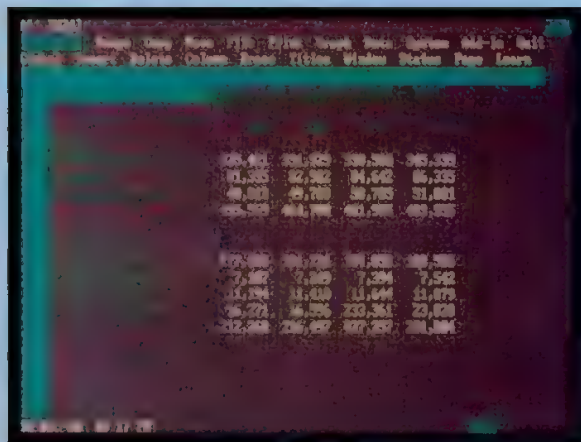


Figure 1: This customized 1-2-3 color scheme replaces the black background and white letters with warm gray and cream tones. Other palettes are shown in Figure 3, and a table of corresponding hexadecimal values is listed in Figure 4.



Figure 2: Norton Utilities' DiskEdit program offers a simple way to change files at the byte level. Shown above is the area of 123.SET that includes the hex values for the screen colors. The cursor marks the first value.

Spreadsheets

foreground. I use 38h for the background and border and 37h for the foreground. These values give me cream letters and numbers on a mid-gray background and border. The default cyan used for the frame stands out nicely against this combination, as you can see in Figure 1.

Assuming you use a different shade for your foreground, background, frame, and border and that each element can be any of 64 colors, you have more than 16 million color combinations to choose from. Even if you opt to keep the background and border the same, you still have about a quarter of a million potential combinations. At least one of these should

prove to be more exciting than the one that Lotus provides.

Michael Cowan
Nottingham, Great Britain



Judging by the mail I receive, it appears that many readers share Mr. Cowan's dissatisfaction with 1-2-3's default colors. I, too, find them drab. Note that Mr. Cowan's remedy works only for Release 2.2.

If you're going to modify 123.SET, the first and most important step is to *make a backup copy*. That way, if you happen to alter the wrong stretch of code, you'll be able to restore the original file and try again. You might want to copy 123.SET to a file named COLORS.SET. Then change the COLORS file instead of the original 123.SET. To run 1-2-3 with the altered SET file, just type 123 COL-

ORS at the DOS command line.

You can use DEBUG to make your changes, or you can use any other program that lets you modify files at the byte level. *The Norton Utilities* will do nicely.

Figure 2 shows the region to be modified, as seen through the eyes of the *Norton Utilities'* DiskEdit program. The first color byte lies under the cursor in this figure. Note that the offset from the beginning of the file—4E01—may be different on your system.

In addition to the screen elements mentioned by Mr. Cowan, you can change the colors of the WAIT light and unprotected text. The WAIT light is set by the fifth byte in the sequence, and the unprotected-text color is determined by the 11th byte. The unprotected-text color is also used in 1-2-3's settings sheets and add-in sign-on screens.

Figure 3 (top left) shows the Lotus 1-2-3 spreadsheet with a default color palette. The spreadsheet is titled "PROFIT AND LOSS PROJECTION - 1991". The data is as follows:

	Q1	Q2	Q3	Q4
Revenues				
Product Sales	325,421	331,929	338,568	345,339
Rentals	81,335	82,982	84,642	86,335
Maintenance Fees	48,813	49,789	50,785	51,881
	455,569	464,700	481,995	483,555
Cost of Sales				
Material Costs	177,688	181,234	184,858	188,555
Packaging Costs	7,187	7,249	7,394	7,542
Shipping Costs	11,194	11,418	11,644	11,879
Sales Commissions	16,271	16,596	233,361	23,828
	212,268	216,497	437,257	231,884

Figure 3 (top right) shows the Lotus 1-2-3 spreadsheet with a brightened color palette. The data is the same as in the top left screenshot.

Figure 3 (bottom left) shows the Lotus 1-2-3 spreadsheet with a custom color palette. The data is the same as in the other screenshots.

Figure 3 (bottom right) shows the Lotus 1-2-3 spreadsheet with a custom color palette. The data is the same as in the other screenshots.

Figure 3: The first three screens (moving clockwise from upper left) show how you can change the Lotus 1-2-3 default palette to hues that have more pizzazz or to ones that are easier on your eyes. You can even brighten up the original's cyan and green, as shown in the lower left screen. The hex values that will generate each of these palettes is shown in Figure 4.

Spreadsheets



HEX VALUES FOR 123.SET

Figure	Palette (Foreground/background/frame)	Hexadecimal string
Figure 1	Cream/gray/cyan	38 01 02 03 04 05 06 37 08 09 0A 0B 0C 0D 0E 1F 38
Figure 3 (upper left)	Black/white/cyan	3F 01 02 03 04 05 06 00 08 09 05 0B 0C 0D 0E 1F 00
Figure 3 (upper right)	White/blue/green	01 01 02 02 04 05 06 3F 08 09 24 0B 0C 0D 0E 1F 00
Figure 3 (lower right)	Red/electric green/ black	12 01 02 00 04 05 06 04 08 09 09 0B 0C 0D 0E 1F 00
Figure 3 (lower left)	Bright white/black/ bright cyan	00 01 02 1B 04 05 06 3F 08 09 1E 0B 0C 0D 0E 1F 00

Figure 4: This table lists the hex values that correspond to the screens in Figures 1 and 3. Use your favorite utility or DEBUG to make the byte changes to 123.SET, but *remember to make a backup copy before editing the file*. To be safe, you could make the changes to the copy (COLORS.SET, for example) and then start 1-2-3 with the backup.

The screen shots in Figure 3 give you some idea of how you might enliven your spreadsheet display. The screen in the upper right features bright white text on a sky-blue background—a combination favored by many writers for word proc-

essing. The screen in the upper left evokes the appearance of ink on paper—black characters on a bright white background. The lower-right screen is designed for those who want to think green while they do their finances. Finally, the lower-left

screen keeps the basic color balance of the default scheme, but turns up the gain with bright white, bright cyan, and bright green. The hexadecimal values for each of these palettes is shown in Figure 4.

A good strategy for experimenting with color combinations is to modify only one element at a time. That way, you'll be able to keep track of what you're doing, what works, what doesn't, and so on. A good place to start is the background (the first byte in the sequence), because whatever you choose there will dominate your screen. Then find the foreground and unprotected-text colors (the seventh and 11th bytes, respectively) that give you legible text against your chosen background.

Happy coloring!

HINTS, TIPS, QUESTIONS

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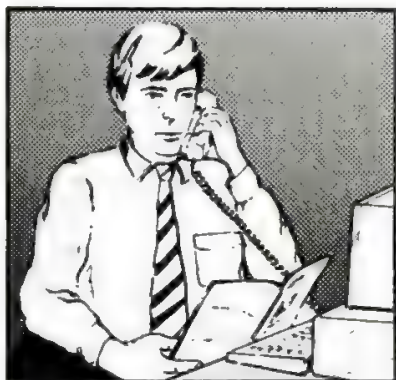


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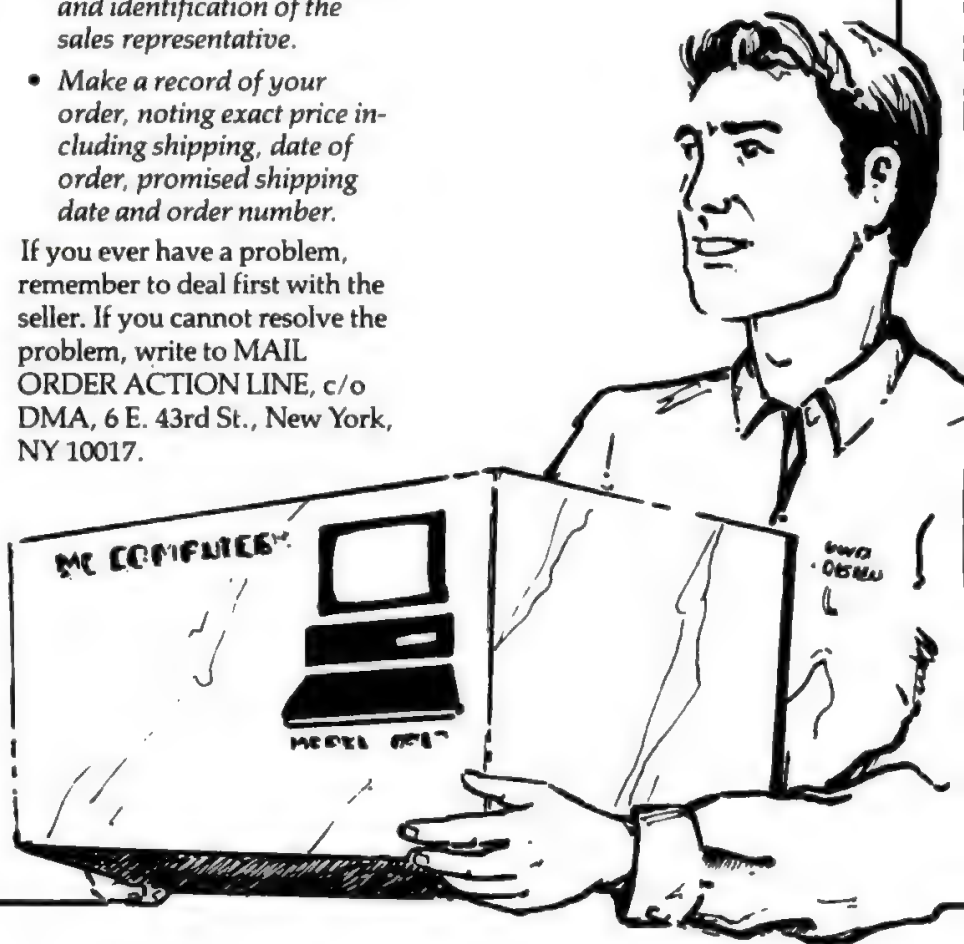
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by
Costa Rodis

The Working Word

MULTIMATE-TO-WORDPERFECT

I convert my old *MultiMate* documents to *WordPerfect* 5.1 format by retrieving them and then running a macro that changes all the *MM* codes to *WP* codes. But I have run into an annoying problem.

When I use List (F5), I can retrieve the *MultiMate* documents about 80 percent of the time. But sometimes *WordPerfect* displays the message "ERROR—Incompatible File Format" and won't pull up the file. This happens even with *MultiMate* files that are slightly altered versions of ones I was able to retrieve.

I found a solution with the command Text In/Out (Ctrl-F5), DOS Text (T), Retrieve (R). Using this sequence, I can pull the recalcitrant file into an active one.

Bruce A. Carr

Shaker Heights, Ohio



WordPerfect's Text In/Out function is very handy for retrieving ASCII text into *WordPerfect* or for saving a *WordPerfect* document as an ASCII file. But I would hesitate to use it for retrieving files formatted by other programs—the results are rarely predictable. Perhaps Mr. Carr and other readers with similar problems should consider using the Convert utility, a separate program included with *WordPerfect*.

Convert is fairly accurate and fast with *MultiMate*-to-*WordPerfect* conversions. To use it, exit from *WordPerfect* (F7) and change to the directory where your *WordPerfect* program files reside (usually C:\WP51). Type CONVERT and tap the Enter key. CONVERT will prompt you for the name of the input file. Enter the full filename and path of the file you wish to convert. At the prompt, "Name of output file," enter the path and filename that you would like assigned to the converted file. Next, the utility displays a list of conversion options. IBM, DCA, Navy DIF, Spreadsheet DIF, *Wordstar 3.3*, *MultiMate Advantage II*, and *Microsoft Word 4.0* files can all be converted to and from *WordPerfect* 5.1 with most of the

- **MULTIMATE-TO-WORDPERFECT:** You can convert *MultiMate* files manually, but it's a lot faster to use the *WordPerfect* Convert utility.
- **EXCEL CHARTS IN WORDPERFECT:** Simply install an HP Plotter driver in *Windows* and importing *Microsoft Excel* charts is a snap.
- **CHANGE YOUR .DOC:** Many programs use a .DOC default extension. But with *Word for Windows*, you can define your own default and avoid confusion.

formatting intact. The time taken to use Convert is significantly less than that taken by Mr. Carr's manual method.

While Convert is convenient, third-party programs such as *Perfect Exchange* can often handle tricky conversions with less possibility of error. Third-party utilities can also convert a much greater number of file formats to or from *WordPerfect*.

EXCEL CHARTS IN WORDPERFECT

WordPerfect and *Microsoft* products appear more incompatible than they really are. You can insert an *Excel* chart into a *WordPerfect* document if you first convert the chart to Hewlett-Packard Graphics Language format. Create the HPGL format by adding one of Hewlett-Packard's plotters to your list of output devices in *Microsoft Windows*. Then configure the plotter to a file (for instance, OUTPUT.PRN

in *Windows 2.x*) instead of to a port. Below is a detailed list of steps to follow for adding a Plotter in *Windows*.

For *Windows 3.0*:

- Run Control Panel.
 - Double-click on Printers.
 - Choose Add a Printer.
 - Add one of the Hewlett-Packard plotters (for example, 7475A).
 - Choose Configure.
 - Choose File.
 - Click on OK and then OK.
- For *Windows 2.x*:
- Pull up the WIN.INI file in the *Windows* directory.
 - Make a backup of the file.
 - Search for [Ports].
 - Type OUTPUT.PRN= under the [Ports] heading.
 - Save the WIN.INI file.
 - Run the CONTROL.EXE program.
 - Choose Installation, Add New Printer.
 - Insert the *Windows* Utilities disk 1 into drive A:
 - Choose the HP Plotter.
 - Choose Setup, Connections.
 - Choose HP Plotter on None under Printer.
 - Choose OUTPUT.PRN under Connection.
 - Click on OK.
 - Close the Control Panel.

Once you're in *Excel*, make sure the HP Plotter is the selected printer. Open (or create) the chart you want to import into *WordPerfect*. Under the File menu, choose Print. The chart will be printed to OUTPUT.PRN (*Windows 2.x*) or a filename you specify (*Windows 3.0*) in the default directory. Import the chart into *WordPerfect* using the Graphics feature (Alt-F9).

You'll find the chart looks best in *WordPerfect* if you've used at least a 14-point font for any text in your *Excel* chart. Also, use *Excel*'s File, Page Setup command to remove any headers and footers.

I use this importing trick to help political scientists and economists at the University of New Hampshire prepare journal

The Working Word

articles that incorporate *Excel* charts into *WordPerfect* 5.1 and 5.0 documents.

Terri Winters
Durham, New Hampshire



It's more bothersome to add a printer that outputs to disk in Version 2.x than in the latest version of *Windows*. But once *Windows* is set up as outlined above, printing to disk is a breeze. If you have *Windows* 2.x, you can use an ASCII text editor to edit WIN.INI.

To retrieve graphics images into *WordPerfect*, press Alt-F9. A list of graphics box types appears at the bottom of the screen. Choose the one that best suits your chart, then tap C for Create. Type the full path and name of the graphics file at Filename. Then choose from three anchor types: Character attaches the image to the character nearest the current cursor; with Paragraph, the image follows the current paragraph no matter where it is moved; a Page anchor attaches the image to the current page.

Finally, choose a size for the image. When you exit to the editing screen, you'll see a graphic box marking the position where the image should be. You can see the image by selecting Print (Shift-F7) and View document. Figure 1 shows a print preview of a *Quattro Pro* chart saved to HPGL format. Note that the Edit (9) option on the Graphic Definition screen lets you make changes such as rotating, scaling, or moving the image.

Also consider choosing Graphic On Disk from Contents (2) on the Graphics

Definition screen. This lets you use the graphic without importing it directly into your *WordPerfect* file. If the image is in a format other than *WordPerfect*'s, you're prompted to save it in .WPG format. If you're using HPGL, conversion can reduce the size of the graphics file by half or better. The document and graphic files remain separate—and you avoid disk bloat.

WordPerfect can retrieve a graphics image printed to disk in many formats, including *AutoCAD* (DXF), Computer Graphics Metafile (CGM), Encapsulated PostScript (EPS), *GEM Draw* (GEM), *Lotus 1-2-3* (PIC), *PC Paintbrush* (PCX), and tagged-image file format (TIFF).

You'll find a full list on pages 279 to 281 of the *WordPerfect* 5.1 manual.

You should be aware that HPGL files printed from *WordPerfect* may not have the sharpness of a graph printed directly from the program that created the image. This is because of the automatic conversion of HPGL files to the .WPG format.

CHANGE YOUR .DOC

I use both *Microsoft Word* and *Microsoft Word for Windows*, depending on the type of document I want to produce. As a result, I have a lot of documents with the extension .DOC—the default for both programs. This is quite irritating, because time and again I try to open a document with the wrong word processor.

Fortunately, there's an easy way around this. Assume you want the extension .W4W as a default for all *Word for Windows* documents. Open the WIN.INI file, back it up, and under the [Microsoft Word] section, add the lines

```
DOC-EXTENSION=W4W
```

If the section doesn't yet exist, enter

```
[Microsoft Word]  
DOC-EXTENSION=W4W
```

Remember to save WIN.INI as a text (ASCII) file.

You can do the same thing with .DOT and .BAK files.

Per Tangerud
Lier, Norway



Word for Windows allows you to create any extension (other than .EXE or .COM) whenever a document is saved. The program can retrieve such a document without any problem. Editing the WIN.INI file simply changes the default document extension. Anyone who uses more than one program can find value in this procedure, especially since so many programs automatically save files with the .DOC extension.

If you do change the default extension, you needn't worry about retrieving documents already saved with the .DOC extension. The WIN.INI file lists all extensions currently and previously in use under the [Extensions] heading. In this way, *Windows* programs "remember" all extensions that have been used.

I would not usually recommend saving files of differing programs into the same directory, but there are times when it is desirable. When you have more than one kind of document in a directory or on the same floppy disk, you should know what program created them.

Make the following additions to the WIN.INI file if you want to change the document backup extension (.BAK) or the document template extension (.DOT):

```
BAK-EXTENSION=XXX  
DOT-EXTENSION=XXX
```

substituting any three-character extension for the variable. I use .WWB for backup documents and .WWT for templates.

TIPS FROM WORKING WORDSMITHS

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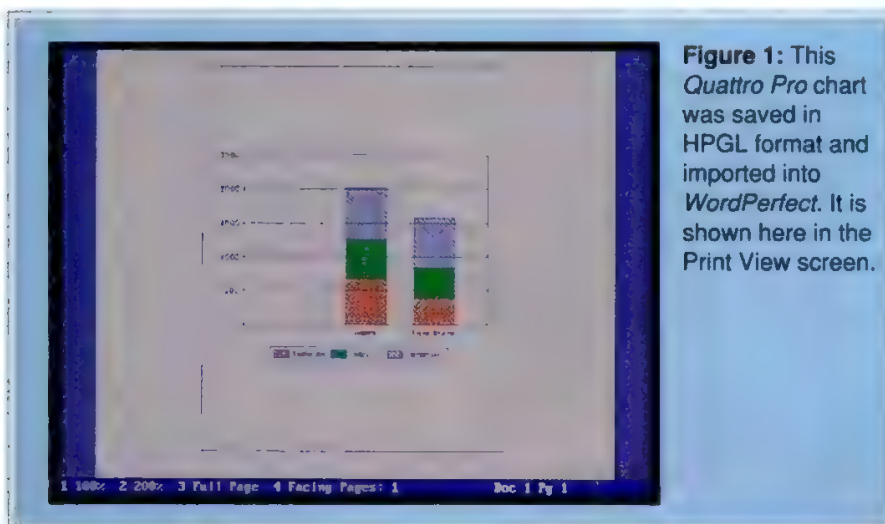


Figure 1: This *Quattro Pro* chart was saved in HPGL format and imported into *WordPerfect*. It is shown here in the Print View screen.

by
Neil J. Rubenking

User-to-User

PRODUCTIVITY TIPS

In dealing with users and clients, I've noticed that they do too much typing and much more work than necessary to perform simple tasks. Here are some of the shortcuts I've discovered that can increase your productivity:

- You almost never need to type *.* following a command; you can use the DOS current directory symbol (a period) instead. For example, instead of typing `COPY *.* B:`, use `COPY . B:`. DOS will copy every file in the current directory to drive B:. The same applies for `ERASE`, `DEL`, and any other command where you might normally enter a file mask, and it applies to the parent directory symbol (two periods) as well. For instance, to get a directory of `C:\QUATTRO` from `C:\QUATTRO\WORK`, just type `DIR . .`, rather than `DIR C:\QUATTRO`. To copy the files in `C:\PROGS` to `C:\PROGS\PROGWORK` from within the latter directory, use `COPY . . .`. DOS assumes that the current directory is the target and copies all the files from the parent directory to the current directory.

- Use the `DEL` command instead of `ERASE`. It's shorter and performs exactly the same function.

- The `DIR` command interprets file templates differently from other commands. If you want to know which files begin with the letter M in the current directory, type `DIR M*`, not `DIR M*.*`. If you want to know what files you have in the current directory that contain only one letter in the filename, type `DIR ?`, not `DIR ?.*`.

You can also get by with specifying only the filename or extension in certain circumstances. For instance, to get a listing of the batch files in the current directory, just type `DIR .BAT`, rather than `DIR *.BAT`. DOS assumes that you want all the files with the extension BAT. To get a list of all the files with filenames of MENU, just type `DIR MENU`, rather than `DIR MENU.*`. DOS assumes that you want every file whose file name is MENU, regardless of its extension.

- Whenever possible, refer to only the directory name in file-related operations.

■ **PRODUCTIVITY TIPS:** Save valuable time and learn about DOS by studying these shortcuts.

■ **A BIGGER ENVIRONMENT:** If you're not shy about patching `COMMAND.COM`, you can raise the default environment size in any DOS version.

Type `COPY \WP50DOCS A:` rather than `COPY C:\WP50DOCS\*.* A:`. Likewise, you can type `DIR \WP50DOCS` rather than `DIR C:\WP50DOCS\*.*`. DOS assumes the current drive if one isn't specified and gives a directory listing of the specified subdirectory. This same technique applies to the root directory—just use the backslash symbol. To see what files are in the root directory while residing in a subdirectory, type `DIR \`. You don't need to change to the root directory or anything else. Use this method when `COPY`ing or `DELE`ting files, too.

- When you mistype a command, you almost never need to retype it completely. If you've already pressed Enter and received DOS's "Bad command or file name" message (or some other undesirable result), use the command-line edit keys to fix your error. Let's say you type `LITUS` to start *Lotus 1-2-3*, and get an error message. First, press the Right Arrow key once to redisplay the first character of the command line. Type O to replace the I, hit F3 to redisplay the rest of the command, and press Enter. What if you had typed `LOITUS`? You'd press the Right Arrow key twice, press Del to remove the unwanted character, hit F3 to finish the command, and press Enter. Alternatively, you could press F2 followed by I to move to the first occurrence of the character I, then hit Del and F3 to delete the I and finish the command.

If you notice an error in the current command but you haven't already pressed Enter, just press F5 to edit the current line and use the edit keys as described above. When you're done, just press Enter.

- If you're ever forced to use `EDLIN` (either at gunpoint or at a remote site where they still use teletype machines), don't press F6 while on a blank line to stop inserting lines. Instead, press Ctrl-C. `EDLIN` will abort the insertion, leaving all previously inserted lines intact. Pressing F6 on a blank line does indeed terminate insert mode. However, it also adds an extra blank line in your file—a line you may have to delete.

- Rather than going to your printer to roll out a sheet of paper, just type

```
ECHO ^L >PRN:
```

Hold down the Ctrl key and press L to get ^L. This sends a form-feed code to the default print device.

- Use the shortcuts that you feel comfortable with, and use only the "shortcuts" that actually save you time.

- And last, but not least, automate whatever you can with batch files and buy a good DOS shell program so that typing is minimal anyway.

Ken Henderson
Amarillo, Texas



I use shortcuts like these constantly—they're almost second nature. It takes someone else to remind me that not everyone knows them. Some of the tips above have appeared in *User-to-User* before; some haven't. As a group, they're a great start for your own personal collection of shortcuts. I hate reaching for the * key, so the tips that avoid it are my favorites.

The fifth set of tips is a brief rundown of the DOS command-line editing keys. Figure 1 lists the keys and their functions. The "retained line" is the last command line you entered. If you press F5 at the end of a line, that line becomes the retained line. Here's a tip: any time you want to edit the

User-to-User

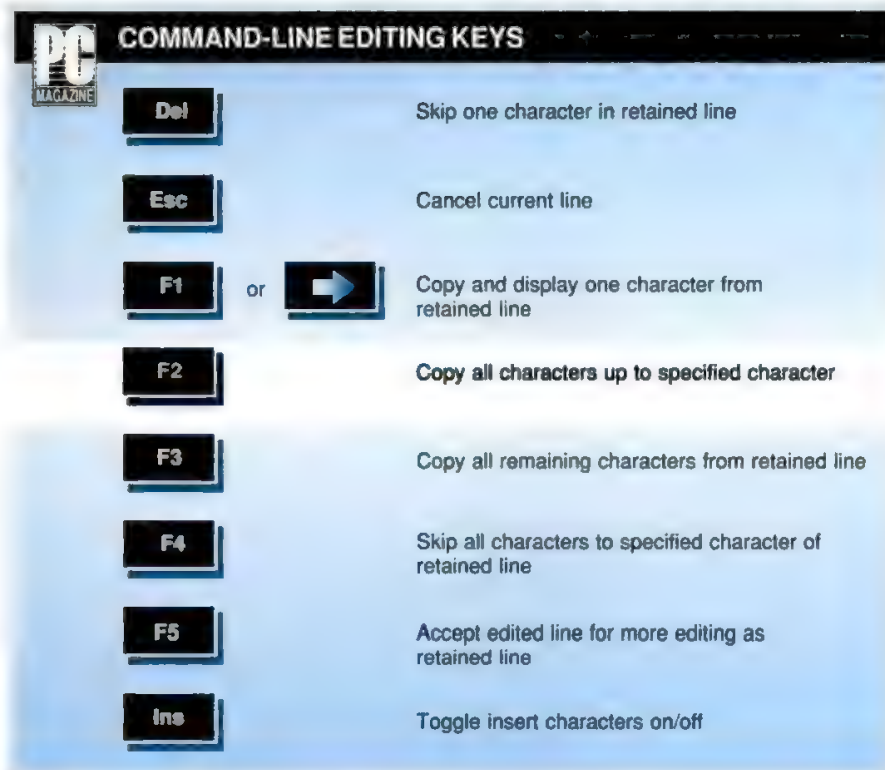


Figure 1: These keys allow you to edit the DOS command line.

previous command, press F3 followed by F5. This gives you a copy of the previous command on the line above the line you're editing. Even with this help, editing the DOS command line is rather awkward, but there's hope. Utilities like CED and 4DOS (available on PC MagNet) let you flip through a stack of past command lines and edit them with ease.

One shortcut not mentioned here is the FOR command. You can make any one-line DOS command act on a whole set of files or other values with FOR. For example, I often create a set of directories on a disk with the command

```
FOR %v IN (A B C D) DO MD A:\%v
```

and then copy matching files to the appropriate directory with

```
FOR %v IN (A B C D) DO COPY %v.*  
A:\%v
```

It looks complicated, but once you're familiar with FOR, it saves time. Note that within a batch file the FOR variable (any single letter) has *two* % signs in front of it, but at the DOS prompt, only one.

A BIGGER ENVIRONMENT

For many users, the default environment size of 160 bytes just isn't enough. Many programs require options placed in the environment, and path/prompt strings keep getting longer and longer. While versions of DOS from 3.1 on have allowed changing the default via a SHELL command in the CONFIG.SYS file, this doesn't help those who still use earlier versions of DOS. Furthermore, processing the SHELL command itself adds a little additional time to every boot-up.

Using the information in the following table, you'll find it's simple and quick to patch COMMAND.COM to enlarge its default environment size once and for all.

DOS version	offset
-----	-----
PC-DOS 2.0	0ECF
PC-DOS 2.1	0ECF
PC-DOS 3.0	0F2C
PC-DOS 3.1	0D11
PC-DOS 3.2	0D4F
PC-DOS 3.3	0EB8
PC-DOS 4.0	1C2A

I've tabled all DOS versions from 2.0 to 4.0,

so anyone can easily expand to a modern standard of 512 bytes. Just substitute the correct offset for the version of DOS you have and follow this example:

```
C:\>DEBUG COMMAND.COM  
-E [offset] 20  
-W  
-Q
```

For DOS 3.3, the second line would be E 0EB8 20. This should end the "Out of environment space" blues.

Calvin R. Shields
Louisville, Kentucky



My DOS references state that the default environment size is 128 bytes for DOS before 3.3 and 160 bytes for DOS 3.3 and later. However, when I booted each DOS version from 2.0 to 4.0 and filled the environment, I found that every version allowed 160 bytes, as stated in the letter above.

Before doing any "surgery" on COMMAND.COM, make sure you have a floppy disk from which you can boot if you make a mistake. Also, to be doubly sure you're patching the right place, *check* that the byte you're changing does in fact have the value 0Ah. The command

```
D [offset] L 1
```

will display that byte. If it's not 0Ah, either someone has already patched your COMMAND.COM or you're patching in the wrong place—potentially disastrous. Note that the table covers PC-DOS only. Don't try to use it with MS-DOS, as the offsets won't match.

You're not restricted to setting a 512-byte default environment. You can set any size you choose, in multiples of 16. Just convert the number of bytes you want to hexadecimal and drop the final 0. For example, 752 is 02F0 in hex. Substitute 2F for 20 in the E command (for instance E 0EB8 2F) and you'll get a 752-byte environment.

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edited by
Trudy Neuhaus

Languages

ACCESSING FULL WORDS IN BASIC

I'm a casual programmer who uses C, BASIC, and assembly language. I frequently use compiled BASIC because it's very easy to use, and I can get the results I need faster than with any other language. One area where BASIC comes up short, though, is in direct memory access. Although the PEEK and POKE commands will accommodate byte-size memory reading and writing, it is often necessary to access a word at a time. Therefore, I wrote a pair of C routines that I call PeekWord and PokeWord, which overcome BASIC's limitation. I hope that other BASIC programmers will find them as useful as I do.

P. Brahmananthan
Reseda, California

PC In my opinion, assembly language is no more difficult to learn and use than C, and it is clearly much more efficient. Furthermore, interfacing a BASIC program to C subroutines is an unnecessarily complex process, at least when compared with interfacing to assembler. In this case, a BASIC program that calls a C routine that in turn calls the C runtime library will probably be no more efficient than simply coding the routine in BASIC in the first place. In addition, because of the way C routines are called, extra code must be generated by the compiler to "fix the stack" upon completion of each call. Therefore, I've rewritten these very useful routines in assembly language, as shown in Figure 1.

Note that for even greater efficiency, the address and value parameters are passed using BASIC's BYVAL directive. This eliminates an extra level of indirection by giving the routines access to the values directly. Otherwise, they would have to first get the address of each parameter and then go to those addresses for the actual values. Also notice the use of simplified segmentation, which requires Microsoft's MASM 5.1 or a compatible assembler. Once the POKWORD.ASM

■ **ACCESSING FULL WORDS IN BASIC:** Here are two assembly routines to access memory a word at a time.

■ **EXTENDING THE BIOS KEYBOARD BUFFER:** Buffer up to 255 keystrokes with this Turbo C++ program.

source file has been assembled, simply link it to the compiled BASIC program as follows:

```
LINK program + pokeword ;
```

—Ethan Winer

EXTENDING THE BIOS KEYBOARD BUFFER

The BIOS keyboard buffer, which is used to hold keystrokes until they are needed by an application, is unfortunately only big enough to hold 15 keystrokes. For some applications, such as text editors or word processors, this simply isn't big enough—particularly if the operator is a fast typist. Furthermore, when this buffer is full, the BIOS generates an annoying beep just to let you know that you've reached your limit.

In order to avoid these frustrations I've written a module, XBUF.C (shown in Figure 2), that provides and maintains a much larger keyboard buffer. You can link it into your applications and create a buffer that can hold up to 255 keystrokes at a time. This handy module installs the extended buffer, allows you to retrieve keys from the buffer, detect the presence of keys in the

POKEWORD.ASM

COMPLETE LISTING

```
;----- POKWORD.ASM
;
;Declare and use these routines as follows:
;
;DECLARE SUB PokeWord(BYVAL Segment%, BYVAL Address%, BYVAL Value%)
;DECLARE FUNCTION PeekWord%(BYVAL Segment%, BYVAL Address%)
;
;CALL PokeWord(Segment%, Address%, Value%)
;Word = PeekWord%(Segment%, Address%)

.MODEL Medium, Basic
.CODE

PokeWord Proc, PokeAdr:DWord, Value:Word

    Les  BX,PokeAdr                ;get the segmented address to poke to
    Mov  AX,Value                  ;and the value to place there
    Mov  ES:[BX],AX                ;put 'er there
    Ret                             ;return to BASIC

PokeWord Endp

PeekWord Proc, PeekAdr:DWord

    Les  BX,PeekAdr                ;get the segmented address to peek from
    Mov  AX,ES:[BX]                ;load AX with the function output
    Ret                             ;return to BASIC

PeekWord Endp
End
```

Figure 1: These useful assembly language subroutines allow a BASIC program to read and write memory a word at a time.

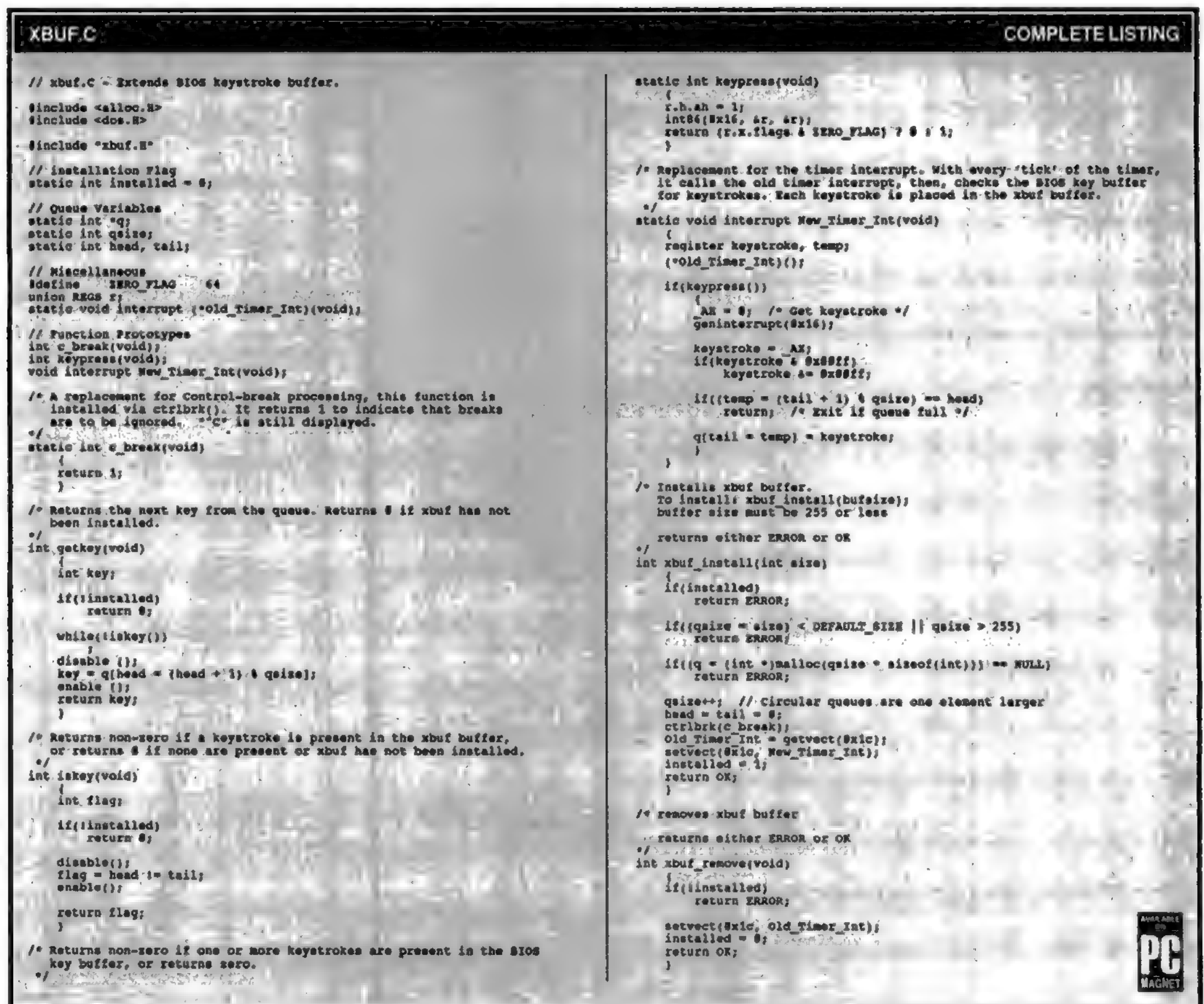


Figure 2: Compile XBUF.C, link it into your applications, and create a keyboard buffer that can hold 255 keystrokes.

buffer, and uninstall the buffer.

The module compiles under Turbo C++, Version 1.0.

Geoff Friesen
Dauphin, Manitoba
Canada



Mr. Friesen's C module, XBUF.C, contains four functions that can be used by an application. You can install extended buffering with

```
int error;
```

```
error = xbuf_install(bufsize);
```

where *bufsize* must be a value from 64 to

255. This function creates the buffer (via *malloc*), installs a Control-Break function, and retrieves the address of the timer interrupt, 1Ch. It then replaces the timer interrupt handler with one of its own, contained in the function *New_Timer_Int*.

This last function does the real work of maintaining the extended buffer. Since it replaces the original timer interrupt handler (pointed to by *Old_Timer_Int*), *New_Timer_Int* is called whenever the 8253 timer chip generates a timer interrupt. When called, *New_Timer_Int* first calls the original timer interrupt handler and then checks to see whether any keystrokes are available from the BIOS keystroke buffer via the internal *keypress*

function. If a keystroke is available, *New_Timer_Int* retrieves it and places it in the extended buffer. Thus, keys are re-

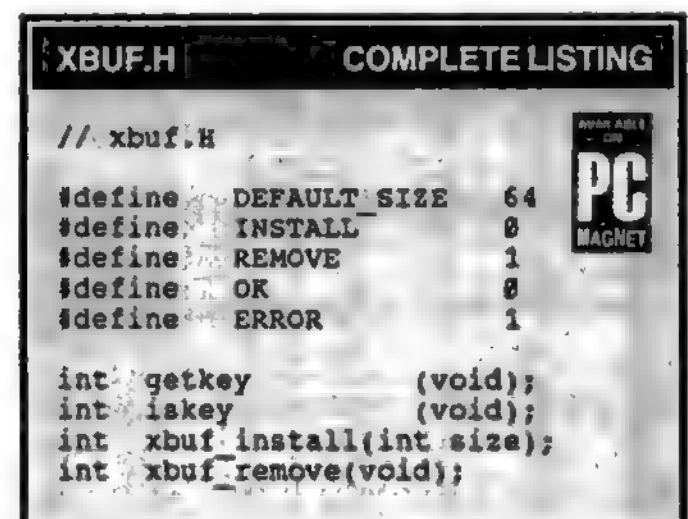


Figure 3: The header file for XBUF.C.

Languages

TESTXBUF.C	COMPLETE LISTING
<pre>// testxbuf.c - demonstrates use of XBUF buffer // // Use C>TESTXBUF to run without extended buffering // Use C>TESTXBUF 1 to run *with* extended buffering #include<conio.h> #include<dos.h> #include<stdio.h> #include"xbuf.h" void main(int argc, char **argv) { int key, XBUF = 0; if(argc > 1) XBUF = 1; if(XBUF) xbuf_install(DEFAULT_SIZE); sleep(5); // Wait 5 seconds if(XBUF) while(iskey()) { key = getkey(); printf((key > 31 && key < 128) ? "%c " : "%x ", key); } else while(kbhit()) { key = getch(); if(!key) key = getch() << 8; printf((key > 31 && key < 128) ? "%c " : "%x ", key); } if(XBUF) xbuf_remove(); }</pre>	

Figure 4: Run this program with any argument to test the effects of extended buffering. If you do not use an argument, you'll experience normal BIOS buffering.

trieved from the BIOS with every timer tick—or 18.2 times per second.

To retrieve keystrokes from the extended buffer, an application should call `getkey` (in place of `getch`) as long as the extended buffer is installed. And the application can use `iskey` (instead of `kbhit`) to determine whether keystrokes are waiting to be retrieved from the extended buffer. Alternatively, you can define macros that will automatically substitute `getch` and `kbhit` with `getkey` and `iskey`, making the addition of extended buffering largely transparent.

Finally, you can uninstall by calling the `xbuf_remove` function. Be sure to include `XBUF.H`, shown in Figure 3, in your program.

Friesen has also provided a program, `TESTXBUF.C`, which is shown in Figure 4, that allows you to test the effects of extended buffering. In order to run `TESTXBUF` with normal BIOS buffering, at the DOS prompt enter

To try extended buffering, run it with any argument as follows:

`TESTXBUF 1`

The program will sleep for 5 seconds before it displays any keys that have arrived. Using a 33-MHz 386 and holding down a key the entire time it was run, I found that without extended buffering (no arguments), `TESTXBUF` captures only a few more keystrokes than its full (15-key-stroke) buffer will allow. But with extended buffering (any argument), it will capture the full 64-keystroke extended buffer.

—Richard Hale Shaw

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by
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Tutor

SEGMENTED MEMORY

I've often heard that Intel processors have segmented memory architectures, and that segments limit the amount of code and data a program can have. Can you explain what segmentation is and elaborate upon the pros and cons of a segmented architecture?

Donald E. Whitelock
Turnersville, New Jersey



In its simplest form, a segment in the Intel architecture is a 64K block of memory. On the 8088, 8086, and 80286 processors, memory in quantities of more than 64K can't be addressed as one flat, linear address space; instead, memory must be broken down into smaller 64K segments and then addressed one segment at a time.

Why *segments*? Intel wanted to enable the 8086 to address a full megabyte of memory. Since the number of different memory addresses you can have is 2^n , where n is the number of bits you're given to represent memory, it was necessary to build a machine that was capable of 20-

■ **SEGMENTED MEMORY:**
Although memory in PCs is laid out in one big linear mass, it's accessed as if it were divided into small, discrete blocks. Here's the story of how and why.

bit addressing ($2^{20} = 1\text{MB}$).

Intel also wanted to keep its internal registers 16 bits wide for compatibility with earlier Intel microprocessors. This immediately created a serious conflict: 16-bit addressing limits you to 2^{16} , or 64K of RAM. So that both goals could be achieved, Intel opted to give the 8086 20 address lines (permitting up to 2^{20} bytes of data to be addressed) but leave the registers 16 bits wide, and set four of them aside for use as *segment registers*—registers whose sole purpose is to hold segment addresses. Using this scheme, the CPU could form a 20-bit address by combining the contents of a segment register, which holds a paragraph address, with an offset register, which holds a byte address. (A *paragraph* is 16 bytes of memory; thus, you multiply by 16 to translate a paragraph address to a byte address). In other words, the segment register contains the address where the segment begins, and the address in the offset register is interpreted as an offset relative to the base of the segment.

Figure 1 shows how two 16-bit values are combined to form the address of a unique location in memory. The segment value is multiplied by 16 to produce the number 12340h (in hexadecimal notation, all it takes to multiply a number by 16 is to add a zero at the end, just like multiplying by 10 in our decimal numbering system). The offset value 0005h is then added to the result, yielding the absolute address 12345h.

By convention, memory addresses are rarely referred to in absolute form. Instead, they're expressed in segment:offset form, with the segment and offset values written in hexadecimal and separated by a colon. The address 12345h, for example, would normally be written as 1234:0005. The advantage to using this notation is that it clearly spells out the values used to arrive at the resultant address.

That's not the only way to arrive at 12345h, of course. The expression 1234:0005 treats it as the fifth byte in the segment based at paragraph 1234h. But it's also the 21st (hex 15) byte in the segment starting at 1233h (1233:0015), the 37th (hex 25) byte in the segment at 1232h (1232:0025), and so on. For any given byte in memory, there are thousands of different ways to formulate its address. In fact, it's a mistake to believe that memory in a PC equipped with 640K of RAM is divided into ten evenly spaced segments. Segments can begin on any 16-byte boundary. They can also overlap, leaving you 4,096 ways to formulate an address (unless of course it's protected mode, in which case there are as many

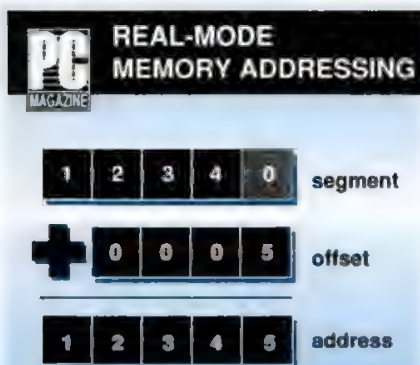


Figure 1: An Intel microprocessor running in real mode forms a 20-bit address by shifting the contents of a 16-bit segment register 4 bits left (to form a paragraph address) and adding a 16-bit offset. Here, the segment address, 1234h, is paired with the offset address 0005h to form the absolute address 12345h.

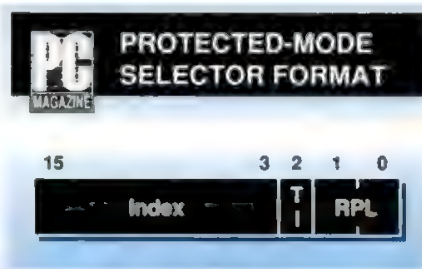


Figure 2: In protected mode, segment registers are loaded with selectors rather than physical segment addresses. The 13-bit index field holds a descriptor number, which references a descriptor in the Global Descriptor Table (GDT) if bit 2 (the Table Index bit) is 0 or in the Local Descriptor Table (LDT) if Table Index is 1. The RPL field holds a number from 0 to 3, representing the requested privilege level, with 0 ranking highest and 3 lowest.

Tutor

ways to formulate an address as there are paragraphs of memory).

One way to view segments is to think of them as 64K windows onto memory that can be moved around as needed to reference specific targets inside a larger, more extensive address space. On the 8086, registers CS, DS, ES, and SS hold segment addresses. By changing a segment register's value, you can move the 64K window associated with that register to a different location in memory. In assembly language, the instruction

```
MOV AL, ES:[1000]
```

means "go to the segment that ES points to and get me the byte at offset 1000h, then place it in register AL." As you may have guessed, the 64K limit on segment size arises from the fact that the largest number that can be formed with a 16-bit quantity, and thus the highest offset that can be addressed within a segment, is 65,535—exactly 64K minus 1.

286 SEGMENTATION

The same concept of segmentation that applies to the 8086 processor also applies to a 286, 386, or 486 running in real mode. Memory addressing is limited to 1MB, and 20-bit addresses are formed from 16-bit values.

In certain cases, you can access more than 1MB of memory in real mode by loading a segment register with a value greater than F000h and combining it with an offset address high enough to produce an absolute address higher than 100000h. For example, the segment:offset address FFFF:1000h actually references absolute address 100FF0h, which is clearly above the 1MB boundary. Since an 8086, with its 20 address lines, isn't physically capable of addressing more than 1MB of RAM, the address wraps around, becoming 0000:0FF0h. But on 286s, 386s, and 486s, selectively enabling the A20 address line (which is normally used only in protected mode) allows the CPU to reach into the first 64K (minus 16 bytes) of upper memory, even though it's running in real mode. This 64K region is known as the *High Memory Area*, or HMA. Microsoft's prototype Extended Memory Specification (XMS) driver HIMEM.SYS, which was discussed in the December 11, 1990,

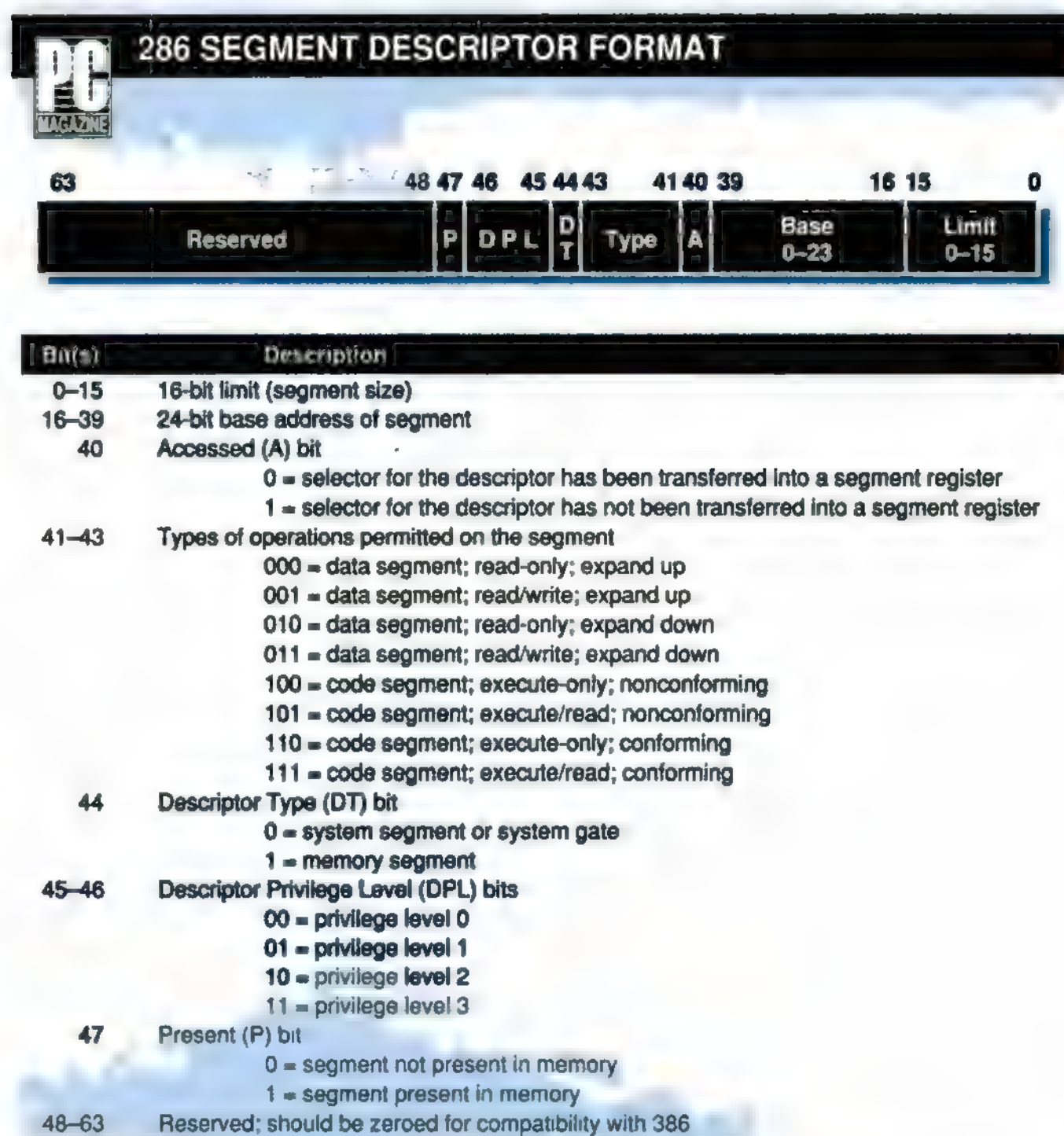


Figure 3: The 286 segment descriptor defines the location in memory and the size of a segment in protected mode. Base addresses are 24 bits long, allowing segments to be located anywhere in the 286's 16MB physical address space. Limits are 16 bits long, restricting the maximum segment size to 64K. Bits 40 through 47 store auxiliary information that defines the segment's privilege level, type, and current status. *Expand down* segments are segments that extend downward in memory, from higher to lower addresses. They are typically used to hold stacks, which also grow downward in memory. *Conforming segments* are special code segments that may be called by processes running with equal or lower privilege levels.

Tutor column, provides a mechanism for controlling the A20 address line and for arbitrating accesses to the HMA among competing processes.

But protected mode is quite different. In protected mode, memory is still segmented, but segment registers hold quantities known as *selectors* rather than segment addresses. Selectors reference descriptors stored in descriptor tables located in RAM, and descriptors, in turn, spell out the physical locations (and sizes) of corresponding segments of memory.

Figure 2 shows the format of a selector. The 13-bit index field serves as an index into one of the system's descriptor tables. One table can hold up to 8,192 different descriptors. The operating system typically sets up several such tables—a

Global Descriptor Table, or GDT, which holds descriptors for segments of memory reserved for operating system use, and a series of Local Descriptor Tables, or LDTs, normally used to map the memory set aside for application programs to govern access to different parts of memory. If bit 2, the Table Index bit, in the selector is 0, then the selector references the GDT; if it's set to 1, reference is made instead to the current LDT (which LDT is current is determined by another register, the LDTR register, located in the CPU).

Bits 0 and 1 hold the Requested Privilege Level, or RPL. Privilege levels play a role in 286/386 memory protection by restricting segment accesses to processes (that is, application programs) with equal or higher privilege levels than the seg-



PROTECTED-MODE MEMORY ADDRESSING

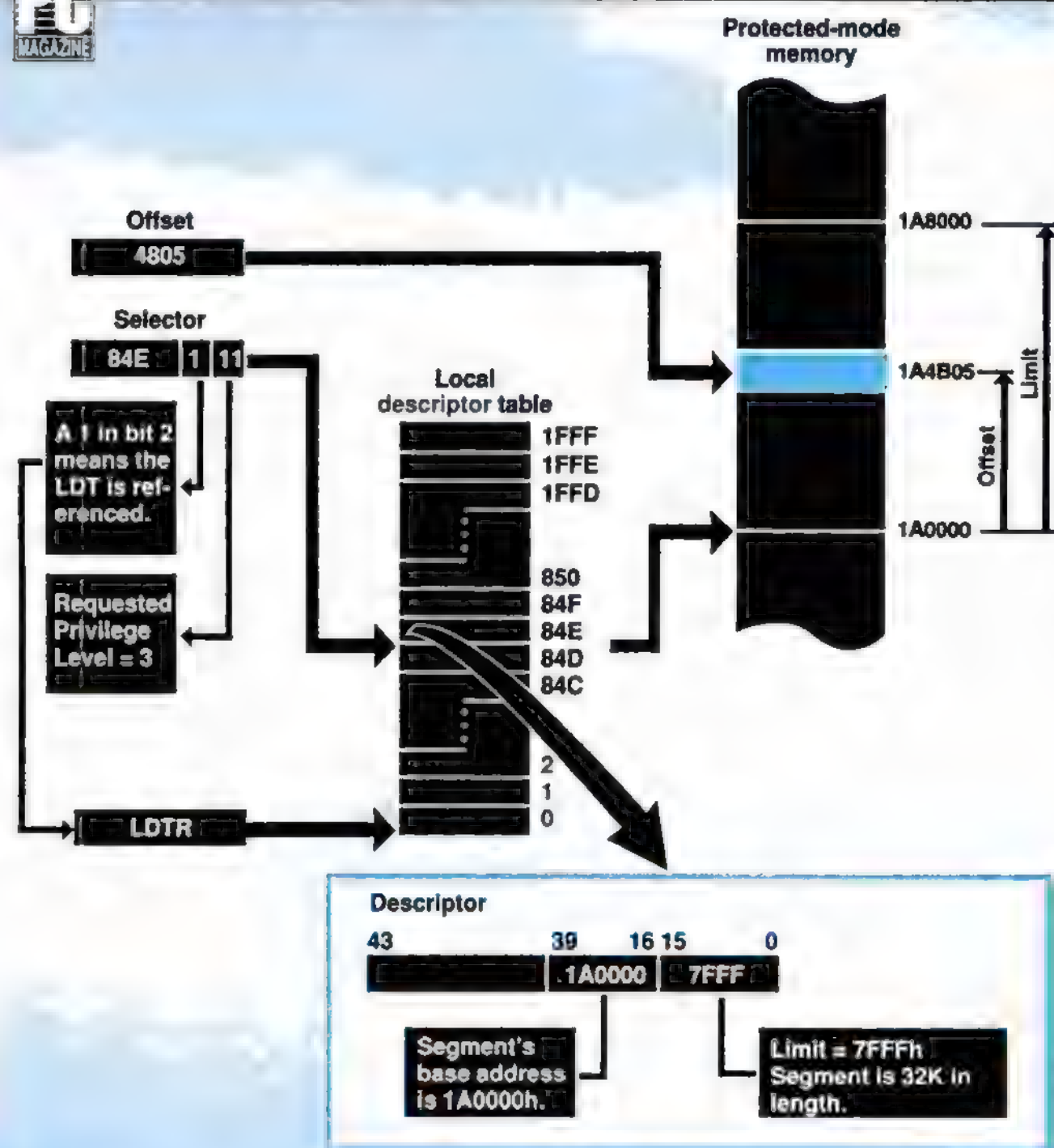


Figure 4: In protected mode, the path to a location in memory is keyed to a descriptor table, where the segment's base address and limit are defined. Here, the selector references descriptor number 84Eh in the LDT. The base address of the segment, 1A0000h, is stored in the descriptor itself, as is the segment's limit, 7FFFh. The offset value 4B05h is added to the base to form absolute address 1A4B05h. The maximum size of the base, limit, and offset is processor-dependent.

ments they're trying to access. In OS/2, for example, regions of memory that belong to the operating system are assigned the highest-possible privilege level, preventing application programs, which run at lower privilege levels, from corrupting operating system data. That's one reason it's called *protected* mode.

Figure 3 shows the format of the 286 segment descriptor. Bit fields within the 64-bit descriptor define where a segment lies in memory and how far it extends. Segment sizes are adjustable on the 286, but the maximum size of a segment is still 64K—the same limit imposed on the 8086. Why? The descriptor's limit field,

which defines the size of the segment, is only 16 bits wide. The limit is the highest offset that can be addressed within the segment; any attempt to access memory beyond the posted limit results in a protection fault. On the other hand, 24 bits are set aside for the segment's base address, permitting the segment to be located anywhere within the 286's 16MB physical address space.

Bits 40 through 47 in the 286 segment descriptor contain auxiliary information such as whether or not the selector for the descriptor has been loaded into a segment register, whether the corresponding segment is a code or data segment and what

types of operations are permitted on it. The descriptor type (whether it points to a memory segment or to some other type of system object, such as a call gate, which allows processes to call routines with higher privilege levels), the descriptor privilege level, and whether the segment is currently present in memory are also found here. This type of information, esoteric as it may seem, is crucial to a CPU operating in a multitasking environment where each process must be protected from others active in the system at the same time.

Figure 4 diagrams the process a 286 goes through to convert an address stored in selector:offset form to a physical address in memory. In this example, the selector references a descriptor in the Local Descriptor Table, whose base address is stored in the LDTR register. The selector's index field holds the hexadecimal value 84E, which points to the 84Eh descriptor in the LDT. The descriptor's base address field holds the 24-bit value 1A0000h, which says that the corresponding segment is based at absolute address 1A0000h, a location approximately midway between the 1MB and 2MB marks. The limit field holds 7FFFh, indicating that the segment is 32K in length. Finally, the offset value 4B05h is applied relative to the base of the segment (just as it is in real mode), yielding the absolute address 1A4B05h.

At a glance, all this may seem confusing. But a closer look reveals some of the inherent advantages to structuring memory this way. By setting up a unique LDT for each process, a protected-mode operating system can load multiple processes into memory and keep them physically isolated from one another. The premise is that a process can't access any region of memory that's not mapped into its LDT. The operating system can also prevent processes from accessing the GDT by running them at lower privilege levels than the GDT allows. In the end, you have a solid foundation for a multitasking environment, where no program can corrupt the system by overwriting memory that has been allocated to another program.

386 SEGMENTATION

Segmentation on the 386 is remarkably similar to segmentation on the 286, but with a twist: the addressing capabilities of the 386 are far superior to those of the 286, providing more flexibility in the way protected-mode memory can be structured. In fact, the 386 was the first Intel CPU to

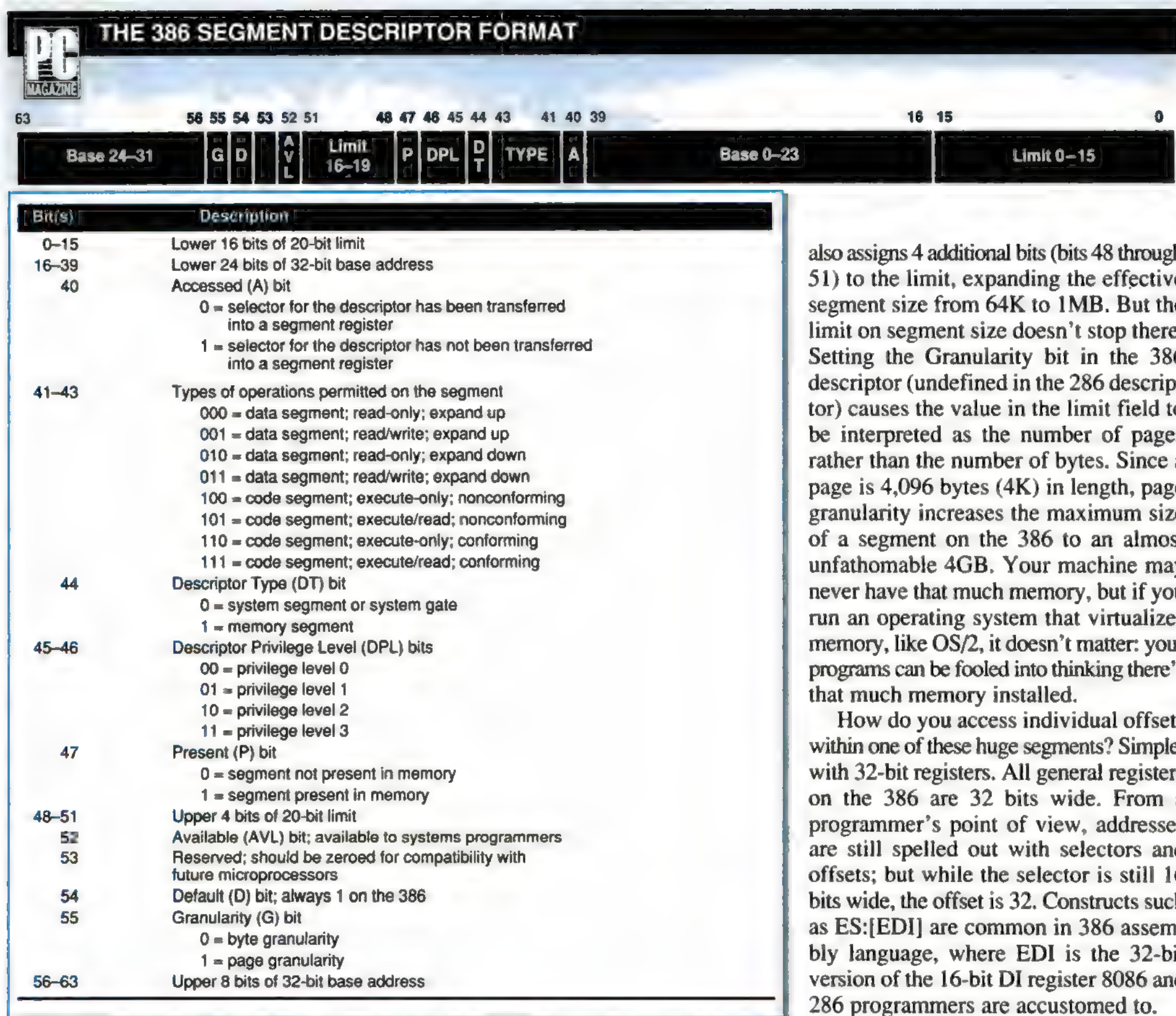


Figure 5: The 386 segment descriptor, an extension of the 286 descriptor, permits segments to be located anywhere in a 4GB address space and individual segments to be up to 4GB in length. Although the 20-bit limit field would at first seem to restrict segment sizes to 1MB, setting the descriptor's granularity bit (bit 55) causes the value in the limit field to be interpreted as the number of 4K pages rather than the number of bytes, resulting in a 4GB ceiling on segment size.

remove the 64K size limit on segments, making it an attractive platform for operating systems that fare better on processors not bound by segmented memory, such as Unix.

Figure 5 maps the contents of the 386 segment descriptor, which is simply an extension of the 286 descriptor. Note the downward compatibility between the two formats: every field that's defined on the 286 is also defined on the 386 in the same

location. As a result, a program written to run in protected mode on the 286 will run fine on a 386, as long as the unused bits in the descriptor are zeroed out, a precaution Intel recommended to 286 systems programmers from the beginning, to ensure compatibility with future CPUs.

The 386 assigns 8 additional bits (bits 56 through 63) to a segment's base address, expanding the range of memory it can be located in from 16MB to 4GB. It

also assigns 4 additional bits (bits 48 through 51) to the limit, expanding the effective segment size from 64K to 1MB. But the limit on segment size doesn't stop there. Setting the Granularity bit in the 386 descriptor (undefined in the 286 descriptor) causes the value in the limit field to be interpreted as the number of pages rather than the number of bytes. Since a page is 4,096 bytes (4K) in length, page granularity increases the maximum size of a segment on the 386 to an almost unfathomable 4GB. Your machine may never have that much memory, but if you run an operating system that virtualizes memory, like OS/2, it doesn't matter: your programs can be fooled into thinking there's that much memory installed.

How do you access individual offsets within one of these huge segments? Simple: with 32-bit registers. All general registers on the 386 are 32 bits wide. From a programmer's point of view, addresses are still spelled out with selectors and offsets; but while the selector is still 16 bits wide, the offset is 32. Constructs such as ES:[EDI] are common in 386 assembly language, where EDI is the 32-bit version of the 16-bit DI register 8086 and 286 programmers are accustomed to.

VIRTUAL MEMORY

Are segments really all that bad? Once upon a time, when the majority of applications were still written in assembly language, they did make life difficult for developers. Segments permeate every fiber of a program's being. It's inherently more difficult to write a program that deals with multiple code or data segments than one that limits its code and data to 64K—the size of a single segment. That's why, for example, good-old BASICA limited code and data to 64K and some language interpreters still do. Fortunately, compilers capable of handling far code and data objects—code and data stored in remote segments—now do most of the work for us.

But segments aren't always the bad

Tutor

guys. In protected mode, they play a crucial role in helping operating systems to virtualize memory. Virtual memory requires that physical memory be partitioned into easily managed units that can be swapped to and from the hard disk. Segments 64K or less in length fit this role quite well. On both the 286 and 386, the descriptor's Present bit (bit 47) is set to 1 when a segment is present in memory and to 0 when it is swapped out.

When a process attempts to access a swapped segment, the CPU generates an exception that is trapped by the operating system. The operating system in turn gets the opportunity to load the segment back into memory, swapping other segments out, if necessary, to make room.

The problem with huge segments on the 386 is that they can be too large to be swapped to the hard disk. They can also be small enough to fit on the hard disk but too large to be swapped in and out efficiently. That's why the 386 supports a second form of virtual memory management known as *paging*. Paging divides all of memory into a series of evenly spaced 4K pages. If segment sizes prohibit swapping at the segment level, pages can be swapped instead.

The 386-specific version of OS/2 due out later this year will use paging rather than segmentation to virtualize memory, enabling developers to set up huge 386 segments without sacrificing the virtual-memory capabilities of the CPU.

If you'd like to know more about segmentation, paging, protection, and virtual memory management on the 286 and 386, here's a list of recommended reading: *Inside the 80286*, by Ed Strauss (1986, Prentice-Hall); *Programming the 80386*, by John H. Crawford and Patrick P. Gelsinger (1987, SYBEX); and *The 80386 Book*, by Ross P. Nelson (1988, Microsoft Press).

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by
Frank J. Derfler, Jr.

Connectivity

LOADING LOTUS ON A NETWORK

I read your column every issue and I've taken advantage of the suggestions that appear in the column. Several of the ideas I've seen have to do with calling device drivers, especially for *Lotus 1-2-3*—probably because everyone knows that *Lotus* causes your system to hang if you execute it with an incorrect device driver.

A recent suggestion used a DOS variable called PSTATION. The PSTATION variable was set to equal a computer's physical station number on a Novell network, using Novell's system login script like this:

```
MAP S1:=SYS:PUBLIC\BATCH
MAP S2:=SYS:PUBLIC
MAP S3:=SYS:PUBLIC\DOS
COMSPEC=S3:COMMAND.COM
SET PSTATION=%P_STATION
```

You then need to include an IF statement for each station that might use the batch file to load 1-2-3. So your batch file could look like this:

```
ECHO OFF
CLS
CD\LOTUS
IF %PSTATION% == 00000000014
  123 MONO.SET
IF %PSTATION% == 00000000023
  123 COLOR.SET
IF %PSTATION% == 00000000069
  123 UNIV.SET
IF %PSTATION% == 00000000035
  123 COLOR.SET
IF %PSTATION% == 00000000032
  123 MONO.SET
IF %PSTATION% == 00000000016
  123 COLOR.SET
IF %PSTATION% == 00000000056
  123 UNIV.SET
IF %PSTATION% == 00000000027
  123 COLOR.SET
CD\
```

This method certainly gets the job done,

■ **LOADING LOTUS ON A NETWORK:** Here's a simple technique for assuring that you load the correct device driver with *Lotus 1-2-3*.

■ **IMPROVING NOVELL'S MENU SYSTEM:** Novell's @ command doesn't always work as it should. Here's a way around the problem.

■ **SETTING UP A FAX SERVER:** Here are some tips for installing a fax server on a LAN.

but if you need to administer it in a large network environment, it could turn out to be quite a nightmare!

As the network administrator for four Novell networks, I've developed an alternative method for accessing 1-2-3 that works very well and requires no modification when nodes are added to the network. First, you create a DOS variable called MONITOR in each computer's AUTOEXEC.BAT. MONITOR is set equal to one of a number of monitor types, perhaps COLOR, MONO, or UNIV for universal. So the AUTOEXEC might look like the following:

```
ECHO OFF
CLS
SET MONITOR=COLOR
IPX
NET3
CLS
F:
LOGIN
```

The MONITOR variable is then evaluated in the batch file that loads 1-2-3, assuring

that the correct device driver is loaded:

```
ECHO OFF
CLS
CD\LOTUS
IF %MONITOR% == COLOR 123
  COLOR.SET
IF %MONITOR% == MONO 123 MONO.SET
IF %MONITOR% == UNIV 123 UNIV.SET
CD\
```

This procedure drastically reduces the number of IF statements required in the *Lotus* batch file, and you don't have to update the batch file if a node is added to the network.

John Salerno
Clifton, New Jersey



Customizing an individual login, particularly for programs like *Lotus 1-2-3*, is one of the favorite topics of our readers. This letter does a good job of explaining the customization alternatives. However, while the use of IF %PSTATION% can certainly be a nightmare, it lets you customize login parameters that you can't equal in any other way. For an example, see the February 12, 1991, Connectivity column, which describes using P_Station to assure that the correct CAPTURE commands are issued at each workstation.

IMPROVING NOVELL'S MENU SYSTEM

Novell's menu system may be very useful to those who don't want to spend hundreds of dollars on difficult menu systems that aren't really needed. The menu is very simple to learn and maintains DOS functionality.

One exception to the DOS functionality is the @ commands. As documented in Novell literature, the @ counter allows the menu user to store values temporarily while the menu is executing. These counters accept on-the-fly input if it's followed by a message surrounded by quotes. For example, the command:

Connectivity

```
COPY @1"Enter filename to copy"  
@2"Enter destination"
```

prompts for the filename and destination and then completes the COPY command using the values in @1 and @2.

When the command is completed, the values in the counters are lost. This is useful for users who don't want to fill up the environment with unneeded values.

But a problem develops for some commands such as Novell's SEND, which allows a user to send a message to another user or group. For instance, the following command will not work:

```
SEND @1"Enter message" @2"Enter  
username/group to send to"
```

because the quotes are stripped from the first value (@1) when it is sent.

For the @ counters to function correctly with the SEND command, a simple workaround will take care of the problem. You simply assign the value of @1 to a DOS environment variable as follows:

```
REM @1"Enter message"  
REM @2"Enter username/group to  
send to"  
SET MESSAGE=@1  
SEND "%MESSAGE%" @2  
SET MESSAGE=
```

This method works very well, and there's no speed lag, since SET is an internal command. You can substitute any word or key combination if you already use MESSAGE as a variable, and if you run out of environment space, you can increase the size of your environment.

Gregory Conran
Newington, Connecticut



If you need to increase your environment space in order to hold the variables you create with SET, insert the following line in the CONFIG.SYS file for each station:

```
SHELL = COMMAND.COM /p /e:xxxx
```

where xxxx is the actual number of bytes in the environment. The /e switch lets you increase environment size from 160 bytes to as much as 32K.

Novell's menu system takes up a lot of

RAM in each workstation, and it isn't as flexible as products like *Saber Menu*, from Saber Software Corp. (800-338-8754), or *LANShell*, from LAN Systems (800-458-5267), but it is free with *NetWare*. By the way, for those of you who want to guide your *Windows* users through your LAN, Saber Software has a new *Windows* version of its menu program.

SETTING UP A FAX SERVER

I'm the network administrator for a Novell LAN that uses Ethernet. We are an engi-

**A major complaint about
LAN fax servers is the
difficulty of routing
incoming messages to
the right person.**

neering firm with 21 workstations on the network and two HP-compatible laser printers that are available to all users.

I'd like to eliminate our standalone fax and replace it with a fax server on the LAN. Our fax use is split fairly evenly between computer-generated material and handwritten documents. So any fax server we purchase would have to provide an easy method for faxing handwritten material. This probably means that we need a scanner as well as a dedicated workstation. The scanner must handle up to 20 pages of notes and drawings at one time.

I want to keep the system simple for my users, and I want them to be able to send and receive from their workstations. Can you suggest where to start in putting together such a system? I'm having a difficult time finding any answers or products.

Eric Gunderson
(via CompuServe)



You'll get a head start by reading the article on LAN fax gateways in the April 10, 1990, issue of *PC Magazine*. I also suggest calling GammaLink (408-744-1430) for information about its GammaFax products.

When you set up a network fax server, you typically dedicate one PC to the role of providing all fax services for every

client station. The fax server has one or more internal fax boards that it uses to send and receive fax images. The software allows this PC to run other applications, but if there's a lot of traffic and if you have an attached scanner, you'll want to dedicate a PC to the fax server role.

Your need to send handwritten documents as well as prepared files presents no problem. You can attach a scanner to the fax server and let any user send images through the scanner. Most flatbed scanners have an option for a sheet feeder that will easily handle more than 20 pages. GammaLink's *GammaNet* software lets users select outbound destinations from their own telephone directories even when they fax from the scanner located at the fax server. Of course, the users can send and view fax images from their own PCs.

There are a couple of interesting things about the GammaLink products that make them appealing for your installation. Your users don't have to run *Windows*, but if they do, the *GammaNet for Windows* software lets them fax directly from a *Windows* 3.0 application, with full fonts and graphics. The *GammaNet* software translates print files created for the HP LaserJet into fax format, so you can send fully formatted documents using the output created by your standard applications.

My major complaint about using a LAN fax server is the difficulty of routing incoming faxes to the right person. Usually someone has to view every fax to determine who's supposed to get it.

GammaLink now offers two different fax boards that accept commands for routing incoming fax images. One of the boards accepts as many as 29 touch-tone digits to designate the recipient of a fax message. The other fax board routes faxes according to the telephone lines they come in on. This feature allows each recipient to have his own incoming fax number. The folks at GammaLink should be able to help you solve your fax problems.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay \$50 for any tip we print. Please submit your letter on a disk along with a printout. Then mail your contribution to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We are unable to answer letters individually. ■

PC Magazine's Direct Marketing Connection for PC Products and Services



Most of you buy PC products and services through direct marketing channels. In fact, in a recent study of subscribers, 83% said they bought PC products from direct marketers.*

You buy direct because you know exactly what you need and you seek good value and fast delivery.

The following special section connects you with the direct marketers who are eager to please you. By having them all in one place, you can quickly zero in on what you need and which vendor you want to call.



JUST FOR BUYERS WHO MEAN BUSINESS.

FastData 386 Systems



FastData 386/33 \$2399

The fastest 386 processor available combined with a 64K thirty nanosecond memory cache make the FastData 386/33 a power users dream! Included in the base price is a 100 megabyte 20 millisecond hard disk, 1024 by 768 VGA monitor and card, four megabytes of memory, and 5.25" & 3.5" high capacity floppy drives. Plus, should anything ever go wrong with your FastData computer, you are covered by a one-year warranty with free on-site service or system replacement if we cannot correct the problem with our FastSHIP advance parts replacement program.

Standard Features

- ✓ 33mhz Intel 386-DX processor.
- ✓ 64K high-speed memory cache.
- ✓ 4 megabytes RAM.
- ✓ 100 mb 20ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Full size (shown) chassis with keylock, speed and reset buttons.
- ✓ 387-DX coprocessor socket.
- ✓ 230 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, game port and two serial ports.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ FCC Class B approved.

System Price	65mb	80mb	100mb	200mb
Monochrome	\$1,799	\$1,929	\$1,999	\$2,499
VGA Color	\$2,099	\$2,229	\$2,299	\$2,599
VGA 1024	\$2,199	\$2,329	\$2,399	\$2,699



FastData 386/25 \$1999

The optimum combination of features, expandability, and power make the FastData 386/25 an ideal choice for those whose applications demand high speed 32 bit processing and expandability. The value of the 386/25 goes far beyond its price; it comes configured with a full four megabytes of fast RAM, a quick 22 millisecond 65 megabyte hard disk, and maximum VGA displaying 1024 by 768 resolution powered by a high-output 16 bit 512K VGA board. Also, the FastMicro team will configure your FastData 386 exactly the way you want, without sending you shopping elsewhere.

Standard Features

- ✓ 25mhz Intel 80386-DX.
- ✓ 4 megabytes of zero wait-state RAM.
- ✓ 65 mb 22ms RLL hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive. (For both add \$69)
- ✓ Standard chassis (shown on left) with keylock, speed and reset buttons.
- ✓ 80387-DX coprocessor socket.
- ✓ 200 watt power supply.
- ✓ 14" Super VGA color monitor, 1024x768 resolution, with 16 bit VGA card with 512K.
- ✓ Clock calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots & 5 drive bays.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Guaranteed compatible.
- ✓ FCC Class B approved.

System Price	65mb	80mb	100mb	200mb
Monochrome	\$1,599	\$1,729	\$1,799	\$2,099
VGA Color	\$1,899	\$2,029	\$2,099	\$2,399
VGA 1024	\$1,999	\$2,129	\$2,199	\$2,499



FastData 486/25

Call about our hot new 486, just \$3,199 with the same standard features as our 386-33 system. Includes a 128K two-stage cache and is expandable to 64mb of memory.

All FastData Systems Include:

- 30 day money-back guarantee
- Toll-free technical support for life
- One year warranty with on-site service available to most U.S. locations

FastData SX Systems



\$1599 FastData SX/20

25% faster than a 16mhz SX, the FastData SX/20 adds even greater performance to its 386 multitasking capabilities. Just \$200 more than our SX/16, this machine also includes a second floppy drive in addition to the standard VGA color monitor and 16 bit VGA adaptor. Keytronics keyboard and 40 megabyte hard drive. The system includes two megabytes of memory and is expandable to eight on the main system board. Remember, when you have questions, need to solve a problem, or want recommendations on products for your system, the FastMicro team is standing by toll-free to provide product support for as long as you own your FastData personal computer.

Standard Features

- ✓ 20mhz Intel 80386-SX processor.
- ✓ 2 megabytes of zero wait-state RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" and 1.44mb 3.5" floppy drives.
- ✓ Standard chassis (shown) with keylock, speed and reset buttons.
- ✓ 200 watt power supply
- ✓ 14" VGA color monitor with 16 bit VGA card with 256K.
- ✓ Clock/calendar, parallel port, two serial ports, and game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Guaranteed compatible.
- ✓ FCC Class B approved.

System Price	40mb	65mb	80mb	100mb
Monochrome	\$1,299	\$1,369	\$1,499	\$1,569
VGA Color	\$1,599	\$1,669	\$1,799	\$1,869
VGA 1024	\$1,699	\$1,769	\$1,899	\$1,969



\$1399 FastData 386/SX

Combine the benefits of an advanced Intel 386 processor, the value of a 286 and the advantages of FastData and you've got the FastData 386/SX! This machine is the choice of those who want to run today's powerful 386 and multitasking software, like Windows, and also want to run their favorite DOS applications at surprising speeds. We've made our customers' favorite options standard: it comes with an ample two megabytes of memory, a high performance 40mb hard drive, and 16 bit color VGA. Compare performance, features, and service and you will find no better SX value. Interested further? Try the FastData 386/SX for 30 days; you have to be happy - if not, we'll take it back.

Standard Features

- ✓ 16mhz Intel 80386-SX processor.
- ✓ 2 megabytes of zero wait-state RAM.
- ✓ 40 mb 28ms IDE hard disk, 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive. Both drives add \$69.
- ✓ Standard chassis with keylock, speed and reset buttons (mini desktop shown - add \$50).
- ✓ 200 watt power supply
- ✓ 14" VGA color monitor with 16 bit VGA card with 256K.
- ✓ Clock/calendar, parallel port, two serial ports, and a game port.
- ✓ Keytronics 101 key keyboard.
- ✓ 8 expansion slots, 5 drive bays.
- ✓ 80387-SX coprocessor socket.
- ✓ Full Shadow RAM and LIM 4.0 EMS support.
- ✓ Windows & Mouse add \$99.
- ✓ Guaranteed compatible.
- ✓ FCC Class B approved.

System Price	40mb	65mb	80mb	100mb
Monochrome	\$1,099	\$1,169	\$1,299	\$1,369
VGA Color	\$1,399	\$1,469	\$1,599	\$1,669
VGA 1024	\$1,499	\$1,569	\$1,699	\$1,769

FASTMICRO

For information or to order call:

1-800-441-FAST

Hardware

DISK DRIVES

Colorado DJ-10 40-120mb Int. Tape	249
Conner (see IDE controllers below)	
CP3044 40mb IDE 28ms	269
CP3104 100mb IDE 25ms	499
CP3208 200mb IDE 25ms	849

Mitsubishi 60mb AT Kit

\$349 RLL encoding, 1:1 controller, and 22ms access time make this a quick performer. The perfect upgrade for your 286 or 386 compatible, this kit comes with everything you need including controller and cables.

Micropolis	
MC1664 340mb ESDI 14ms	1395
Miniscribe 80mb IDE 19ms	479
Mitsubishi 60MB AT RLL MRS35	269
NEC CDR-3501 External CD-ROM Drive	399
Plus Development	
HardCard IIXL 50 - 52mb 9 ms 16bit	399
HardCard IIXL 105 - 105mb 9 ms 16bit	679
Impulse 42mb 12 ms 16bit IDE Kit	399
Impulse 105mb 9 ms 16bit IDE Kit	599

Toshiba 1.44mb Floppy Drive

Complete with mounting brackets and installation instructions, this Toshiba works in all true 286 & 386 compatibles. Will also read/write/format 720K 3.5" disks. Rails, add \$5.

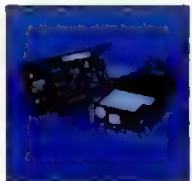


Seagate	
30MB XT Kit ST238 w/ cont.	249
40MB AT ST251-1 MFM Drive	239
40MB AT ST157A 28ms IDE Drive	249
80MB AT ST296N SCSI Drive w/adaptor	349
89MB ST1102A 19ms IDE Drive	419
125MB ST1144A 19ms IDE Drive	499
210MB ST1239A 15ms IDE Drive	799
330MB ST2383E 16ms ESDI Drive	1289
Tec	
720K 3.5" Floppy	59
1.2MB 5.25" Floppy	65
1.44MB 3.5" Floppy	65

Toshiba \$549

100mb IDE Kit

Upgrade your 286 or 386 to IDE technology and Toshiba quality at a FastMicro price. This kit comes with a fast 20ms 100mb drive and built-in 1:1 controller, 16 bit IDE card with dual floppy controller and cables, 5.25" brackets and rails. Call our experts for all your drive needs. Model MK234FC.



Toshiba	
360K 5.25" Floppy (Black)	69
1.2MB 5.25" Floppy	69
1.44MB 3.5" Floppy	69
65mb MK134 22ms RLL drive	279
100mb MK234FC IDE 3.5" drive	499
Western Digital Disk Controllers (also see FastData)	
WD 16 bit IDE Host - No Floppy/With Floppy	39/49
WD1006V-MM2 MFM AT 1:1 Controller	79
WD1006V-SR2 RLL AT 1:1 Controller	89
WE1007V-SE2 ESDI AT 1:1 Controller	149

Panasonic Super VGA

\$439 The Panasonic C1381 will do VGA up to 1024x768 interlaced resolution. It has a dot pitch of .28 and is compatible with all standard VGA cards. Includes swivel base and VGA cable.



BOARDS

Artisoft Lantastic	
Lantastic 2mbps Starter Kit - Two Station	369
Lantastic 2mbps Adaptor	169
Lantastic Ethernet Starter Kit - Two Station	499
Lantastic Ethernet Adaptor	239

ATI VGA Wonder + \$189

New and improved, the ATI VGA WUNDER+ is faster than VRAM. It does interlaced and non-interlaced 1024x768 modes, is 100% register compatible, and comes with extensive software drivers. A free mouse is included as an added bonus. 512K version \$219.

ATI	
2400 ETC Internal	Call
2400 ETC External	187
9600/E External MNP V.42bis	479
VGA Basic 16	75
VGA Wonder + 256K	189
VGA Wonder + 512K	229
Brown Wagh Sound Blaster	149
Everex	
1200B Int Modem	55
2400B Int Modem	99
EGA 480 Card	79
RAM3000 16 bit RAM card	75
RAM8000 16 bit RAM card	169
Hercules Graphic Card +	169
Intel	
8087-2	115
287XL Faster than the 80287-10	199
387-DX20	369
387-SX16	319
Logitech	
ScanMan Plus	165
Scanman 256	289
Orchid	
ProDesigner	179
ProDesigner II 512/1mb	279/329
Tiny Turbo 286	207
Tiny Turbo Xtra	267
Paradise	
Basic VGA - 8 bit	109
VGA 1024 256K/512K	175 199

Practical Modem \$449 9600SA

This external modem features V.42 and MNP error correction combined with MNP/5 and V.42 bis data compression to provide total high speed throughput. The PM9600SA is also V.32 TCM, V.32, V.22 compliant and comes with a five year guarantee too.



Practical Peripherals	
1200B Int Modem	59
2400B Int Modem	125
2400B Int with MNP	169
PM9600SA Ext. V.32/V.42bis	449
Prometheus	
Promodem 1200B Internal	48
Promodem 2400B Internal	98
Promodem 2400G External	149
Tiara Networking	
Lancard/A PC (Arcnet)	75
Lancard/E Star 8 (Ethernet)	139
Lancard/E AT (16 bit Ethernet)	249
USRobotics	
2400 Baud Internal	119
2400 Baud External	147
Courier HST 14,400 Ext.	579
Courier HST 14,400 Int.	539
Video 7	
VGA 1024 256K	179
VGA 1024 512K	209
Vega VGA	149
V-RAM VGA 512K	299

MONITORS

Mitsubishi	
1410 EGA	325
Diamond Scan 1381	479
NEC	
Multisync 2a	469
Multisync GS 2a	199
Multisync 3d	629
Multisync 4d	Call
Panasonic C1381 VGA	439
Pricetown	Call
Seiko CM1440/1450	519/659
Sony 1304 Multiscan	669
Zenith 1492	Call

FastData Products

FastData 16 Bit VGA

The FastData 16 bit VGA card features 256K of video memory, does CGA, EGA, & VGA up to 1024x768 and comes with drivers for popular software including Windows 3.0. It's expandable to 512K and has a 30 day money-back guarantee.



FastData 16bit 1mb VGA	169
FastData CGA Card	35
FastData MGP Card	29

FastData 2400 Baud Internal Modem

The FastData 2400 baud internal modem is fully Hayes compatible and can be configured to COM port 1-4. It has an internal speaker, is auto answer & auto dial, and comes with BitCom software.

9600B SendFax w. 2400B Modem	99
MFM 16 Bit 1:1 Hard/Floppy Disk Cont.	59
Parallel/Dual Serial/Game Card	29
RLL 16bit 1:1 Hard/Floppy Disk Cont.	69
XT 1.44 Dual Floppy Controller	35

FastData Monitors

Your best value, we have a complete line made for us by leading manufacturers like Samsung & Hyundai. Like all FastData products, you have a full 30 day money back guarantee. Shown is the VGA Color for \$279.



FastData Monitors	
12" Amber Monochrome	79
14" Amber Monochrome	119
14" White Monochrome	119
14" White VGA Monochrome	129
14" CGA Color 52 dot pitch	199
14" VGA Color 39 dot pitch	279
14" VGA Color 31 dot pitch	319
14" Super VGA 1024 x 768 28 dp	349

PRINTERS

Canon BJ10E	319
BJ300	Call

Citizen GSX140

Loaded with features, this 24 pin printer is a hot seller! It comes with 6 resident fonts, paper parking, and Epson & IBM printing modes. It does up to 192 CPS and has a unique LCD control panel that lets you set everything without DIP switches. Upgrade to color anytime for just \$39.



Citizen	
200GX	189
GSX140 / GSX145	285/Call
Diconix 150 Plus	329
FujitsuDL3400	359

NEC	
P3200	269
P3300	369
P6200	469
P6300	629

NEC Silentwriter 2 Model 90 \$1645

PC Magazine's editor's choice! The new NEC model 90 comes with 2mb of memory. Postscript by Adobe with 35 fonts, and parallel, serial and AppleTalk interfaces. All this and 6ppm speed, an easy-to-use LCD operator panel and letter, legal & envelope feed.



OKIDATA	Call
Panasonic	
KXP1180	155
KXP1124	297
KXP1624	429
KXP4420 Laser	829
KXP4450/4455 Lasers	Call
Seiko Smart Label Printer	167
Star	
NX1001	149
NX1500	299
NX2410	249
XB2410 / 2415	429 569
Texas Instruments Microlaser PS35	1699

FastData 286/12 \$799

Imagine a fast 286 computer at a super price and you've got the FastData 286/12. This system is complete, not stripped. You get one megabyte of zero-wait-state memory and a 28ms IDE hard disk - standard. Also included is an amber monitor and graphics card, your choice of a high density 1.2mb or 1.44mb floppy drive and a Keytronic keyboard. And since it's a FastData, you are backed with toll-free technical support, one year warranty with the FastShip replacement program & on-site service plan, and our 30 day full money back satisfaction guarantee!

- ✓ 12mhz 80286 processor.
- ✓ 1 megabyte RAM.
- ✓ 40 mb 28ms hard disk 1:1 interleave.
- ✓ 1.2mb 5.25" or 1.44mb 3.5" floppy drive
- ✓ Standard chassis (shown with optional chassis - \$50)
- ✓ Five drive bays.
- ✓ 200 watt power supply.
- ✓ 287XL coprocessor socket
- ✓ Monochrome monitor with monochrome graphic board.
- ✓ Clock calendar, parallel port, and two serial ports.
- ✓ Keytronic enhanced 101 keyboard.
- ✓ 8 expansion slots, 6 available.
- ✓ Full documentation.
- ✓ FCC Class B approved.

System Price	40mb	65mb	80mb	100mb
Monochrome	\$799	\$869	\$999	\$1,169
VGA Color	\$1,199	\$1,169	\$1,299	\$1,369
EGA 1000	\$1,199	\$1,269	\$1,309	\$1,409

Software



DATABASE & FORMS

askSam 5.0	209
Avery List & Mail Plus	37
Clanon Personal Developer	45
Clanon Professional Developer	449
Clipper 5.0	489
DataEase	459



Personal R:Base \$69

Whos says power-
ful relational data-
bases are expensive.
Not with the new
easy-to-use Personal
R:Base. It has intu-

itive pull-down menus that let you query your data, build quick forms and reports automatically and even build applications without complex programming.

dBase III+	439
dBase IV	479
dBXL Diamond	129
Formbase	299
FormTool Gold	52
Formtiller	85
Foxbase Plus	177
FoxPro	417
Paradox 3.5	489
Per:Form Designer & Filler	155
Personal Rbase	69
Q & A	214
RapidFile	99
Rbase for DOS	447
Reflex	159

DESKTOP PUBLISHING

Adobe Postscript Cart. for HPLJ-II	279
dB Publisher Professional	389
GEM Desktop Pub	159
Pagemaker	479

Corel Draw Version 2.0 \$359

Winner of all the top awards, Corel Draw gives you more for your money. It supports the new Windows & includes incredible drawing and editing tools. Includes over 100 typefaces and 300 pieces of clipart. Corel Draw converts scanned art to smooth vector images in seconds. This is the most complete illustration package we've ever seen!



PFS First Publisher	89
Printshop	33
Publisher's Paintbrush	149
Publish It!	135
Ventura Publisher Gold / Windows	519

FINANCIAL

Bedford Integrated Acct	145
DAC Accounting 4.1	79
DAC Bonus Pack 4.1	119
DAC Payroll 4.1	57
Dollars & Sense	Call
Macintax 1040 for Windows	57

COMPLETE III \$139

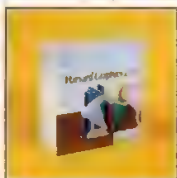
A super value! Includes General Ledger, Accts. Receivable, Accts. Payable, Invoicing, Purchase Order, Payroll Inventory, Job Cost, Fixed Assets and more. Loaded with over 450 reports, automatic back-up and helpful manuals.



Managing Your Money	125
Money Matters	49
One White Plus G/L, A/P & A/R	159
Peachtree Complete III	139
Peachtree with Data Query	209
Quicken	36
Taxview 1040 Prof. for Windows	299
Turbo Tax Personal 1040	39
Turbo Tax Professional	209
Wealth Builder	129

GRAPHICS

Autosketch 3.0	139
Corel Draw 2.0	359
Design CADD 3-D	185
DrawPerfect	265
Freelance Plus	307
Generic 3D Drafting	199
Generic Cadd Level 2 Starter Kit	95
Generic Cadd 5.0	219
Harvard Graphics	289
PC Paintbrush IV Plus	289
Perspective Jr	69
PFS:First Graphics	89



Harvard Graphics \$289

The leading business graphics package, Harvard Graphics lets you create superior charts and graphs with ease. Plus, it comes with advanced drawing tools and symbol libraries, imports Lotus spreadsheet files, and has advanced 3D features.

INTEGRATED

First Choice	89
Framework XE	95
Geoworks Ensemble	115
LotusWorks	89
SmartWare II	417
Symphony 2.2	489
Works	89

MICE/INPUT

Keytronics KB101 Keyboard	59
Keytronics Professional Mouse	59
Logitech HiRes C9 Serial	65
Logitech HiRes C9 Bus	76
Logitech Trackman Serial	75



Logitech C9 Serial Mouse \$65

Our best-selling mouse is upgraded also. Comes with software to adjust the resolution just the way you want it and includes driver software and Pop-Up Dos to make your computer hum at your fingertips. For PaintShop, add \$15.

Logitech Senal w/Windows	127
Microsoft Serial or Bus Mouse only	89
Microsoft Serial or Bus w/ paint	85
Microsoft with Windows 3.0	147
Z-Nix Serial Mouse w/Windows 3.0	99

PROGRAMMING

Macro Assembler	89
Microsoft C Compiler	303
Turbo C++	129
Turbo C++ Professional	189
Turbo Pascal	90
Quick Basic	60
Quick C	60
Quick Pascal	60

SPREADSHEETS

Allways	106
Excel	309
Lotus 1-2-3 version 2.2	325
Lotus 1-2-3 version 3.1	399

Lotus 1-2-3 Version 2.2 \$325

The standard for spreadsheets, Lotus 1-2-3 version 2.2 is faster and more powerful than previous versions that made it famous. Includes add-in manager and more functions for greater flexibility. Also comes with Allways for great presentations made easy.

Lucid 3-D	53
Quattro Pro (call for details)	89
Supercalc 5D	289

WORD PROCESSORS

Facelift for WordPerfect	57
Grammatik IV	49
LetterPerfect	119
Multimate 4.0	267
Professional Write	149
Rightwriter	58
Sprint	117

WordPerfect 5.1 \$239



What can we say? WordPerfect is the #1 rated word processor and the top-selling software in the U.S.A. It's got almost every feature imaginable and yet it is easy to use. The current version adds pull-down menus, mouse support, table creation and equation editor. Add this to the best software support in the business and you can't go wrong!

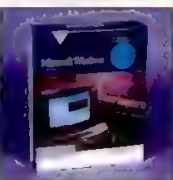
Word	209
Word for Windows	309
Word Perfect 5.1	239
Word Perfect Add'l Station	153
Word Perfect Office	79
WordStar Professional	Call

Call On Non-Listed Items

WINDOWS SOFTWARE

Adobe Illustrator	279
Adobe Type Manager	59
Ami	115
Ami Professional	287
Asymetrix Toolbook	279
Bitstream Facelift	57
Corel Draw 2.0	359

Windows 3.0 \$89



The graphical user interface everyone is talking about! Turns your 286 or above with 640K or more of memory into a powerful multitasking workstation that runs even non-Win-dows applications. Plus, if you buy Windows 3.0 now from FastMicro, we'll throw in 10 of the best Windows shareware programs.

DBfast/Windows	189
Excel	309
Form Publisher	139
Grammatik IV for Windows	49
HDC First Apps	46
HDC Windows Express	46
Micrographix Draw +	149
Micrographix Designer	449
MicroPhone II	199
Microsoft Mouse w/ Windows 3.0	147
Microsoft Productivity Pack	39
Microsoft Windows Developer's Kit	309
Pagemaker	479
Per:Form Pro	259
Powerpoint for Windows	309
Project for Windows	429
Publisher's Powerpak for Windows	45
Windows 3.0	89
Windows Entertainment Pack	27
WingZ Spreadsheet	309
Word for Windows	299

Serial Mouse with Windows \$99



This high-resolution serial mouse by Z-Nix is ergonomically designed and has adjustable resolution. This bundle includes Microsoft Windows 3.0 (5 25" disks only) and mouse software.

ENTERTAINMENT & EDUCATION

Bannermania	21
Carmen SanDiego Deluxe Edition	45
F-19 Stealth Fighter	38
Hunt for Red October	19
King's Quest 5 (VGA Vers.)	38
Leisure Suit Larry II or III	35
Microsoft Flight Simulator	38
Aircraft & Scenery Designer	37
Microsoft Learning DOS	22
NFL Challenge	55
PC Globe or PC USA	35
Simcity	28
Tetris	19

FAST MICRO



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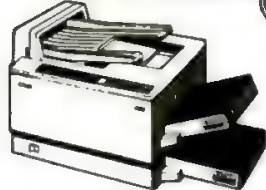
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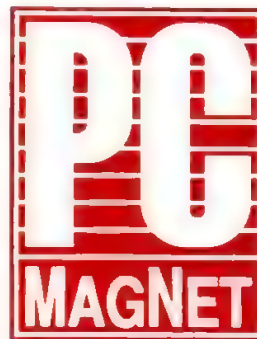
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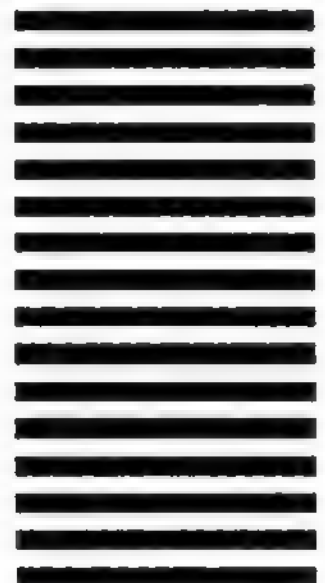
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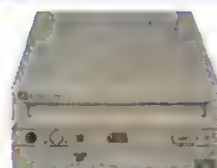
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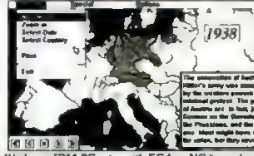
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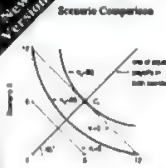
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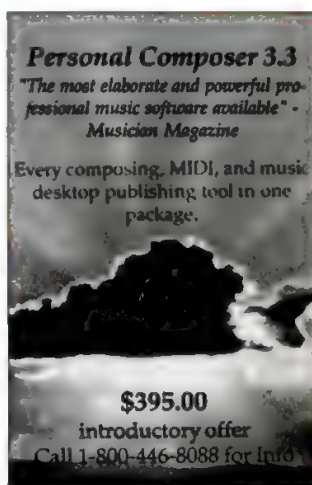
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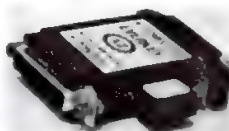
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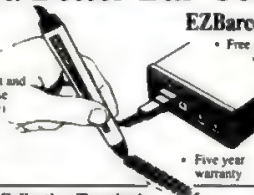
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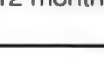
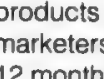
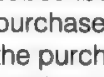
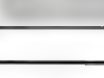
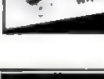
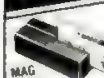
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COMING UP

■ LOTUS 1-2-3 ACCESSORIES

Despite the many recent upgrades of *Lotus 1-2-3*, a thriving aftermarket continues to supply all kinds of enhancement products that fill the gaps in the world's most popular spreadsheet. Contributing editor Craig Stinson explains your options and looks at more than 20 add-in packages, including optimizers, forecasters, financial tools, and an assorted collection of utilities that make your spreadsheets easier to use.

■ 33-MHz EISA-BASED 486 PCs

Are PCs that use the 32-bit EISA architecture ready for the market? Or do these systems' performance gains really come from souped-up components like buffered hard disk controllers and giant external processor RAM caches? *PC Magazine Labs* tests 22 EISA 486/33 PCs to determine whether the extra performance is worth the extra cash.

■ WINDOWS FONT MANAGERS

One of PostScript's most useful features is its ability to generate fonts in the right sizes and styles as needed. Now, for any *Microsoft Windows* applications, your LaserJet (or any type of printer) can gain this advantage by using one of the five font managers in this upcoming review.

■ DISKLESS WORKSTATIONS

The need to protect sensitive data, the wish to do away with the droning whirl of hard disks and fans, or the desire for more desktop real estate are all good reasons for choosing small-footprint diskless workstations over a full-fledged PC. We review everything from a system that piggybacks onto a monitor to one that can attach, with Velcro, to the side of your desk. The beauty of these devices is that you don't give up anything; these 386-class workstations pack all the processing power and memory a power user could want. ■



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After Hours

Products for the Leisure Side of Personal Computing

Mouseware for Preschoolers: Disney Brings Mickey to the PC

EDUCATION
by Don Trivette

When the name on the box says "Walt Disney," we have a right to expect something really special. Three new educational programs from Disney Software: *Mickey's ABC's*, *Mickey's Colors and Shapes*, and *Mickey's 123's* are indeed special. This remarkable software will keep your preschoolers enthralled hour after hour, and at the same time teach them the foundations of shape, color, reading, and counting.

Mickey's ABC's: A Day at the Fair begins with Mickey sound asleep in his bed. If you have the optional Disney Sound Source (please see sidebar, "Mommy, is That the Computer Talking?"), you'll hear Mickey snoring. Each letter on the keyboard is associated with an ob-

ject in Mickey's house—from the apple in the refrigerator to the zipper on his jacket. And yep, there's a xylophone by the bed.

Animation and the optional sounds are tied to the objects. When you press "V," for example, the word *Violin* appears at the top of the screen and a school-teacherish voice pronounces the word while Mickey locates the instrument and plays a few squeaky bars. Once you've exhausted the items in the house, "F" sends Mickey out the door to a fair where there are lots of new things (airplanes to zucchini) to explore. For variety, some surprise animations—like a violin string that breaks and a hotdog that squirts out of its bun—occur on a random basis.

Mickey's Colors and Shapes: The Dazzling Magic Show is a three-act production that teaches

colors and shapes. A flexible keyboard overlay with pictures of five shapes and eight colors allows even the youngest toddler to participate in and control the action. Pressing one of the marked keys causes something to happen every time.

In the first act Mickey juggles objects selected by color or shape. If you allow more than 10 seconds to go by without adding an object, Minnie comes on stage and stamps her foot. Mickey drops the objects, and turns red from embarrassment. It's charming touches like this that make all of these Disney games so enjoyable for both kids and adults.

In the second act Mickey creates pictures from various objects like rectangles, circles, and triangles. Pressing the "circle key," for example, might put circular flowers in a park, while a rectangle adds a bus to the picture. Pressing the yellow key might draw a big golden sun in the sky. More than 35 different pictures can be created, and when everything is just the way you want it, they can be printed



on a dot matrix printer in a coloring-book format.

The third act has Mickey looking for a small animal that escaped from his magic hat. Again, colors and shapes dominate the interface. You press the yellow key, for example, to see if the critter is hiding behind the

CONTINUES



Mickey's ABC's, from Disney Software, combines basic preschool concepts with the quality animation for which Disney is best known.



Mickey's 123's draws young children into the learning process by literally turning pre-math skills into a surprise party for Mickey's friends.

After Hours

Disney Software

CONTINUED

yellow bookcase.

Mickey's 123's: The Big Surprise Party introduces kids to numbers and counting. Mickey plans to give a surprise party for one of his friends. You get to select the guests by number—1 for Goofy, 2 for Daisy, 3 for Minnie, etc.—and mail the invitations. Shopping for food and favors—5 hamburgers, 8 french fries, and 2 balloons—requires more counting. Then it's off to the toy factory where you pick a gift and watch the giant all-purpose-toy-making-machine turn out a gift-wrapped present. Once at the party you count out food and gifts for the guests.

There are 18 different scenes and more than 60 animations in *123's*, each of which is activated by one of the number keys. Because this game has a sequence of activities that tells a story, it will appeal to slightly older kids.

Each of the Disney games comes with an instruction booklet with a few pages devoted to software installation and lots of good ideas about how to get the

most out of the programs. The *Colors & Shapes* booklet, for example, has sections on "Becoming a Play Partner for Your Child," "How Children Learn the Words for Colors and Shapes," "Different Ways Children May Use the Program," and "When Your Child Plays Without You." The Disney people are to be applauded for including all of this insightful material.

The kids in my neighborhood love playing Disney's new games and can only be pried away from my overworked PC in tearful tantrums. The EGA graphics are spectacular and the animation is truly Disney quality. My only criticism is of the needlessly troublesome software-security scheme, which consists of 64 poses of Mickey on red copy-proof paper. Each game has its own difficult-to-see easy-to-mix-up sure-to-be-lost code sheet. The developers promise to simplify security on future products.

Unlike Disney's first software entry—the lackluster *Duck Tales*—these games are superbly engineered kiddie-ware. Although all three games are aimed at kids in the two-to-five year-old age range, *Shapes and Colors* is more appropriate for younger

MOMMY, IS THAT THE COMPUTER TALKING?

by Don Trivette

All three of Disney's new games use a proprietary sound system—called The Sound Source—for speech, music, and sound effects. The \$39.95 accessory consists of a speaker box (9-volt battery not included), a too-short cable, and an adapter plug. The adapter plug is a pass-through device that fits between the parallel printer connector and the printer cable on the back of the PC. It's a simple, inexpensive way to activate Mickey's vocal chords. The cable can be replaced or extended with a standard

modular telephone cable.

If your computer is already equipped with one of the popular sound boards like AdLib or Roland, you're out of luck; these Disney games, like all future Disney products, work only with The Sound Source. Although Sound Source's quality isn't high fidelity stereo, it's good enough for Mickey's squeaky voice and will surely thrill your little ones. To encourage buyers, Disney sells a Sound Source and *ABC's* combo pack for \$69.95. You won't be sorry you bought it. ■

children; *123's* requires that activities be completed in an order which older children will find challenging; *ABC's* has a skill level somewhere between the two. But don't be guided too strictly by age level, because kids have a way of rising to challenges.

List Price: *Mickey's Colors and Shapes*, \$49.95; *Mickey's 123's* \$49.95; *Mickey's ABC's*, \$49.95

(with Sound Source, \$69.95); Sound Source alone, \$34.95.

Requires: 512K RAM (640K for Tandy); DOS 2.0 or later; EGA required for *Colors and Shapes*, others may be played on CGA or better; Sound Source highly recommended. Disney Software Inc., 500 S. Buena Vista St., Burbank, CA 91521; 818-567-5360.

CIRCLE 428 ON READER SERVICE CARD

Stickybear Game Enlightens Through Arcade Action

EDUCATION
by Don Trivette

Walt Disney isn't the only one who knows how to entertain and teach the little ones with PC software. Weekly Reader's Stickybear is every bit as full of color, sound, and imagination as Mickey Mouse, and with 14 titles to his credit (from *Shapes to Vocabulary Builder*) the bear has a long lead.

Stickybear's newest adventure is *Word Scramble*, a product designed to entertain and educate the seven-to-eleven-year-olds in your life. The premise is simple arcade action: Stickybear must collect floating stars while avoiding balls that look suspi-

ciously like land mines. Touching a mine subtracts points, while collecting a star adds points and brings up one of three word-game puzzles.

There's a match-the-objects-behind-the-doors puzzle, a find-the-hidden-words-in-the-maze puzzle, and an unscramble-the-letters puzzle. The puzzles are tailored to one of three difficulty levels selected when play begins. At level one, for example, the child gets lots of match-the-objects puzzles and a few three-letter words to unscramble. A utility is included so you can build your own word lists—a bonus for parents teaching their kids a foreign language.

Cheers to Weekly Reader for

supporting the Echo Board, the Covox Speech Thing, and Tandy's built-in hardware as sound options; jeers to Disney for supporting only its own

Sound Source hardware. (Come on Disney, give the consumer a break.)

Although the word puzzles
CONTINUES



The arcade action in *Stickybear Word Scramble* may not hold the interest of today's game-savvy youngsters.

After Hours

Weekly Reader

CONTINUED

are well designed and fun to play—even for an adult—the arcade action is poor; it's so clumsy that older children with a few years of mall arcade experience under their T-shirts quickly lose interest. Still, the game is a buy

for the average six-to-nine-year-old—and for doting grandparents.

List Price: Stickybear Word Scramble, \$49.95. **Requires:** 512K RAM, CGA, EGA, or VGA graphics, DOS 2.1 or later. (DOS 3.0 for 3.5-inch disk version.) Weekly Reader Software, 10 Station Pl., Norfolk, CT 06058; 800-327-1473, 203-542-5553.

CIRCLE 429 ON READER SERVICE CARD

Origin's Latest: Space Theme Meets 3-D Graphics



The time is roughly 650 years in the future, after humanity has discovered another spacefaring race, the cat-evolved Klathri. Humankind's initial greeting was interpreted as a territorial provocation, unfortunately, and it has been war ever since. Combat has been between teams of ultra-modern spacecraft out among the stars, in a manner not unlike that of WWI flying aces.

Such is the setting of Origin Systems' latest release, *Wing Commander*. Dogfights and dodging asteroids aren't exactly new concepts in 1990s game-ware, but they take on fresh meaning when you add state-of-the-art visuals. WC does just that.

It's in the fighting arena that the game shines. Vector graph-

ics and bitmapping provide an unparalleled sense of motion in three-dimensional space. Your console has a wide variety of controls, including advanced weaponry, computerized tracking devices, and a vidcom that lets you issue orders to your NPC wingman or razz the enemy. You can choose among nine "camera" views to track your fighter, the enemy, or a torpedo on its way. Screen tiling, which the game *doesn't* support, would improve your chances of surviving after a momentary glance at the wrong image.

Your Klathri opponents employ sophisticated algorithms to respond to your maneuvers or to initiate their own. Their fighting styles exhibit both individuality and dangerous efficiency. Much the same can be said for the way your computer-driven



While it offers little original thematic material, *Wing Commander* compensates with outstanding graphics.

wingmen adopt different fighting styles. In fact, your comrades-in-arms do this better on the field of honor than when you meet them off-duty. Watching first Lieutenant Tanaka Mari-ko's cool, vicious infighting is a lot more inspiring than seeing her incongruously play the *shakihachi* (a classical Japanese stringed instrument) at the local bar, for instance.

The "you-are-there" effect of surrounding the action with a storyline and characters is clever in conception, but somewhat less so in practice. Mission HQ and the bar (where you get flight hints from computer-controlled characters or view your kill ratio) are excellently drawn, colored and animated. Mouths form recognizable words, but almost nothing else on the faces moves—and no one blinks. It's a little like *Star Wars* meets *Night of the Living Dead*.

The plot structure is well designed, however, with missions of gradually increasing complexity and harrowing odds. Changes in ships, wingmen, and tactical situations keep you off balance. There are medals and promotions for the very quick, and elaborate burial ceremonies in space for the very dead. Best of all, you never feel that your actions are controlled by an outside force, whether it's George Lucas or (as in this case) Origin Systems' game designer Chris Roberts.

A different kind of problem arises whenever the "camera"

moves from the spectacle to you. Suddenly the image is of a brown-haired, Caucasian male in his mid-20s. True, statistics suggest that most *Wing Commander* players will be young Caucasian males. But it would have shown more sensitivity to other players if this visual persona could be customized at the game's starting point with a choice of racial, sexual, and hereditary characteristics.

Documentation is very cleverly handled. Basic commands and installation are thoroughly covered outside the main gaming guide, which is actually a digest-sized magazine (Vol. 1, Number 4) entitled "Claw Marks." It purports to date from 2654 AD, and caters to an audience of space pilots.

Wing Commander will probably be one of the most popular games on store shelves this year. Origin thinks so, too; they've already built in programming hooks to future "secret mission" expansion modules. Stunning graphics, attention to game detail, a remarkable 3-D combat machine and well-simulated NPC personalities move *Wing Commander* to the top of the arcade list.

List Price: *Wing Commander, the 3-D Space Combat Simulator*, \$69.95. **Requires:** 640K RAM; VGA/MCGA, EGA, or Tandy graphics; DOS 3.3 or later. Origin Systems, P.O. Box 161750, Austin, TX 78716; 512-328-0282.

CIRCLE 543 ON READER SERVICE CARD



Your vidcom communicator lets you bark orders at subordinates or curse at enemies as you try to survive in *Wing Commander*.

After Hours

Links from Access Sets New Standards for Golf Simulation Software



The battle of the clubs is heating up—golf clubs, that is. Just a short time ago, Accolade's *Jack Nicklaus' Unlimited Golf & Course Design* was the ranking pro in golf simulations (see *After Hours*, December 11, 1990), but now Access Software has come driving back with *Links*, the most authentic simulation of them all.

The first thing you notice when *Links* draws the tee is the incredible realism of the trees, fairway, and sand traps. The 256-color VGA graphics reveal the texture of the grass and the undulations of the terrain. That's because this *isn't* an artist's conception, but rather a digitized image of a real golf course—in this case the south course of Torrey Pines in San Diego. To achieve this realism a team from Access Software took 500 aerial and landscape photographs along with a video tape of the entire course. The result is 700,000 bytes of course data (ten times as much as other simula-

tions) that produce a seamless terrain; if you hook the first hole too hard, for example, you'll end up on the 6th hole.

This level of visual authenticity is something of an obsession for the folks at Access. They have consistently exploited the VGA adapter's ability to realistically display scanned photographs in 320-by-200 MCGA mode with 256 colors.

Earlier Access titles, including the action/adventure games *Mean Streets* and *Countdown*, and the arcade title *Crime Wave*, have set new standards for visual realism in PC gaming.

Realism is not without a price. It can take a 12-MHz AT-type computer as long as 37 seconds to draw a screen. That time drops to a more comfortable 17 seconds if the computer has an extended memory board like the Everex RAM 8000, into which *Links* can preload graphics and

sound data. Response time can be further reduced by setting the detail of the foreground and background to lower levels, but then you lose some of the 3-D effect. A fast 80386 or 80486-based machine will also speed things up, of course.

Links supports AdLib, Sound Blaster, and the IBM Speech Adapter as optional sound boards, but if you haven't shelled out for one of those you'll still

views, an undulating grid to read the lie, and random pin placement are standard features of both games.

While the *Nicklaus* game includes a golf course design program, a spokesman for Access says its design program won't be ready for another six months. And because it takes so long to digitize a course, there are only two available so far: the standard Torrey Pines and an



Links achieves an unparalleled visual realism by making heavy use of digitized photographs of well-known golf courses.



Links offers you more options to help you control your swing than does Accolade's simulation, *Jack Nicklaus' Unlimited Golf & Course Design*.

hear the solid swack of a swing and the occasional splash of a ball gone amiss, courtesy of Access's RealSound system. While RealSound's digitized sounds are far from high fidelity, they are clear and quite realistic sounding. Strategically placed sound effects add considerably to the immediacy and authenticity of the gaming experience.

As much effort went into the user interface and the mechanics of golf as went into the graphics and sound. The programmers studied the physics of golf-ball flight to duplicate the real thing. The swing panel has more options and controls than does the *Nicklaus* version; each club, for example, has a setting for things like draw, fade, and chip. Instant replay, multiple

optional (\$10) Bountiful Championship course set in the majestic hills of Utah. But Access is hard at work on a selection of other courses and plans to release them at the rate of one every two months.

If you want to design golf courses or "play" with the Golden Bear himself, then *Jack Nicklaus' Unlimited Golf & Course Design* is the right game for you. If you want to play golf as realistically as possible on a PC, then *Links* is where you'll want to tee up. ■

List Price: *Links: The Challenge of Golf*, \$59.95.

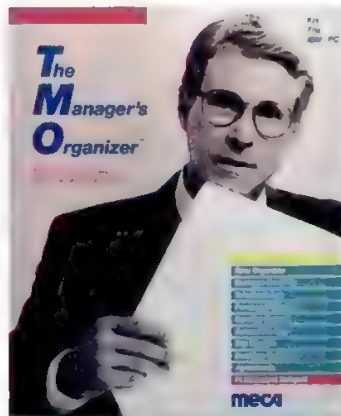
Requires: 640K RAM, hard disk, VGA or MCGA graphics, DOS 3.2 or later. Mouse recommended. Extended or expanded memory suggested for 286 machines. Access Software, 545 W. 500 South, #130, Bountiful, UT 84010; 800-800-4880.

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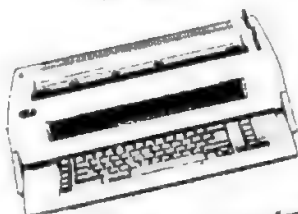
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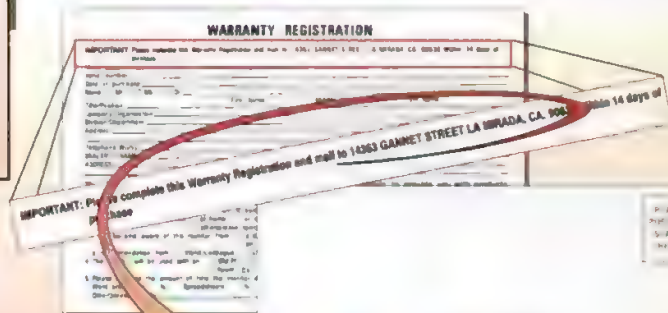
"[The LaserMaster controller board] supports such Microsoft Windows applications as Page-Maker and Ventura Publisher and GEM applications, such as WordPerfect, AutoCAD, and OS/2 Presentation Manager, among others."
Personal Computing, July 27, 1990

If your entry is used in *Abort, Retry, Fail?* we'll send you \$50 and a PC Magazine T-shirt. Caution: In case of multiple entries, the postmark date, neatness and completeness of entry are considered. Winners this issue: Mike Smith (GEM applications), Christopher J. Petit (Samtron warranty), Charles O. Probst (IBM poofreader), Tito Sanchez (You don't need a computer for Pilotlog)

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Flight Computing Catalog, Winter 1990



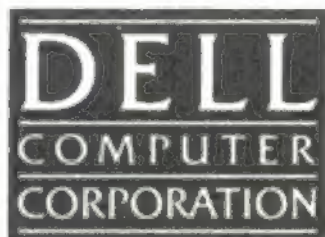
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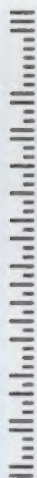
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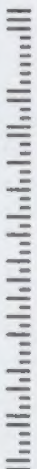
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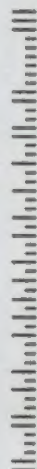
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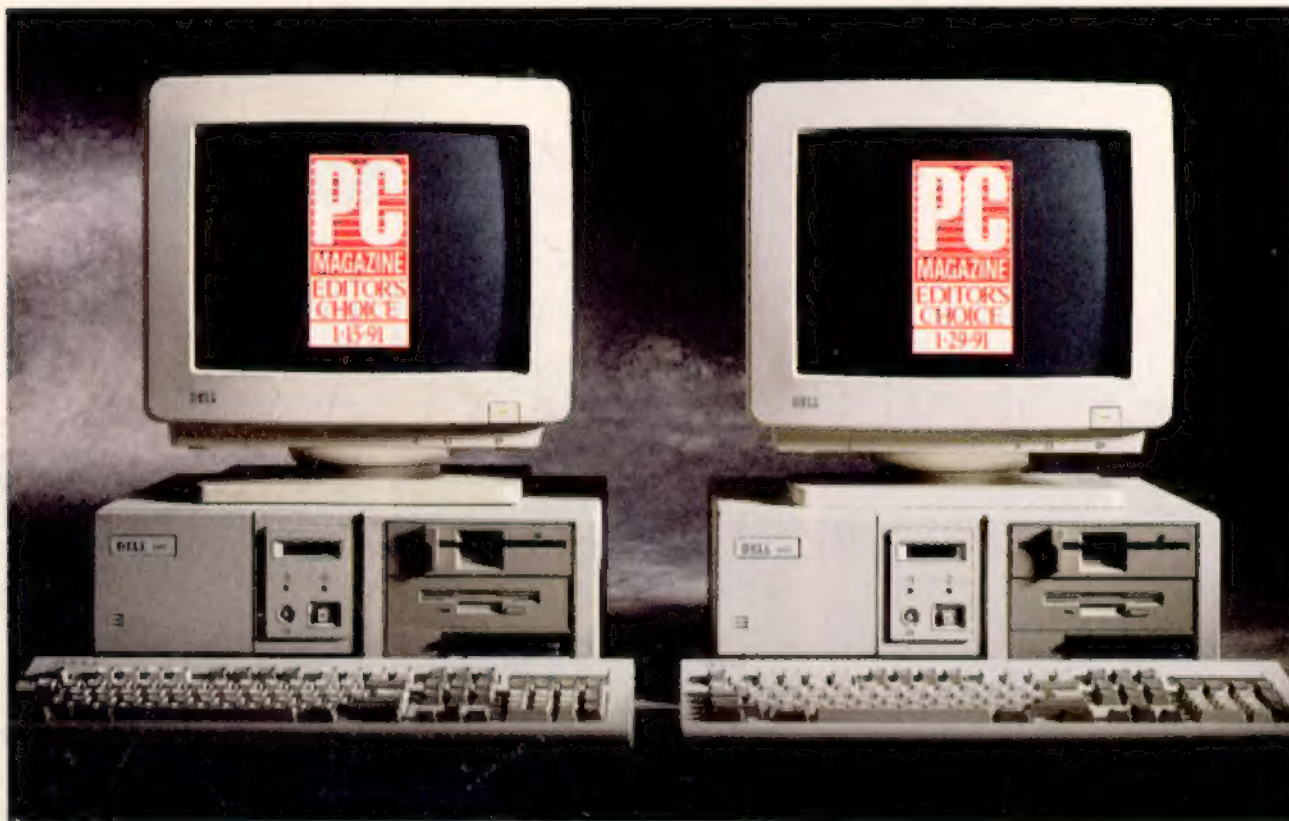
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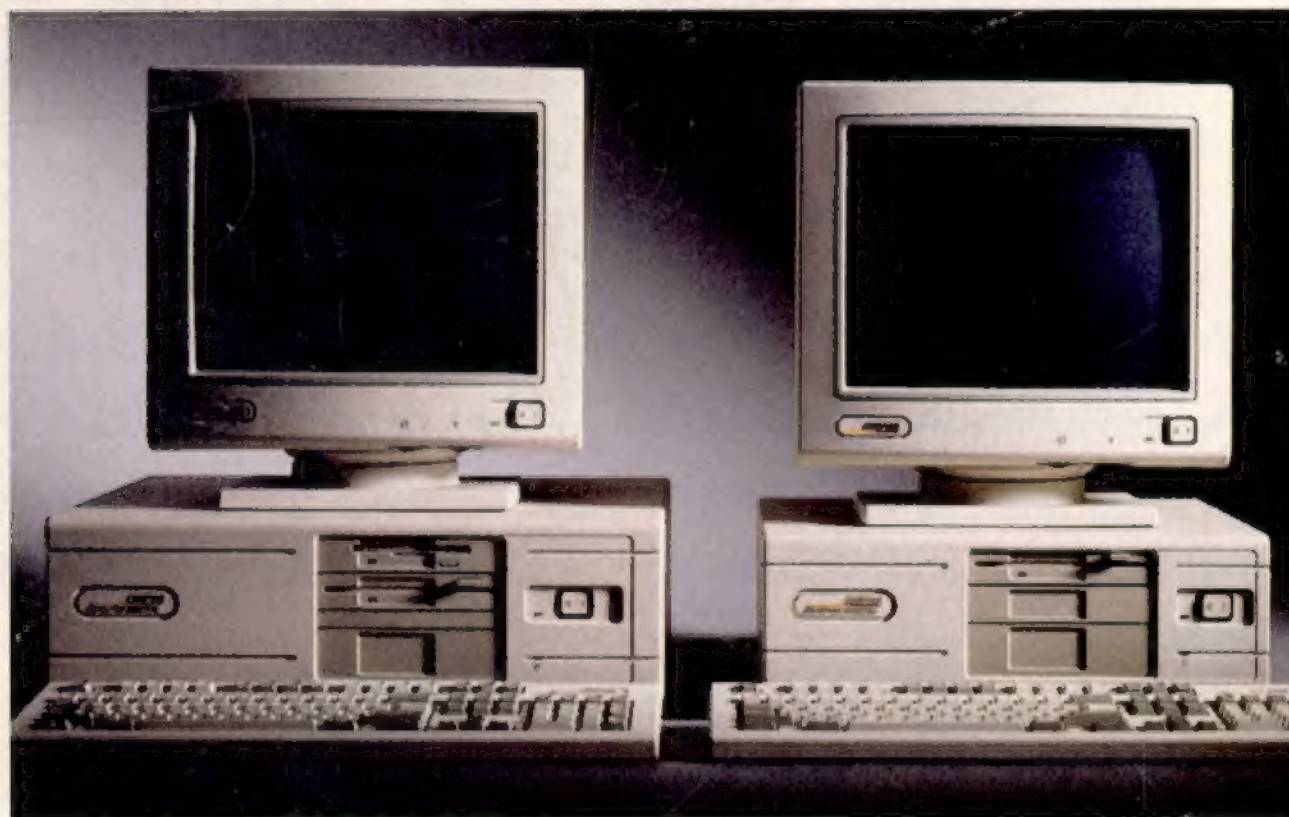
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